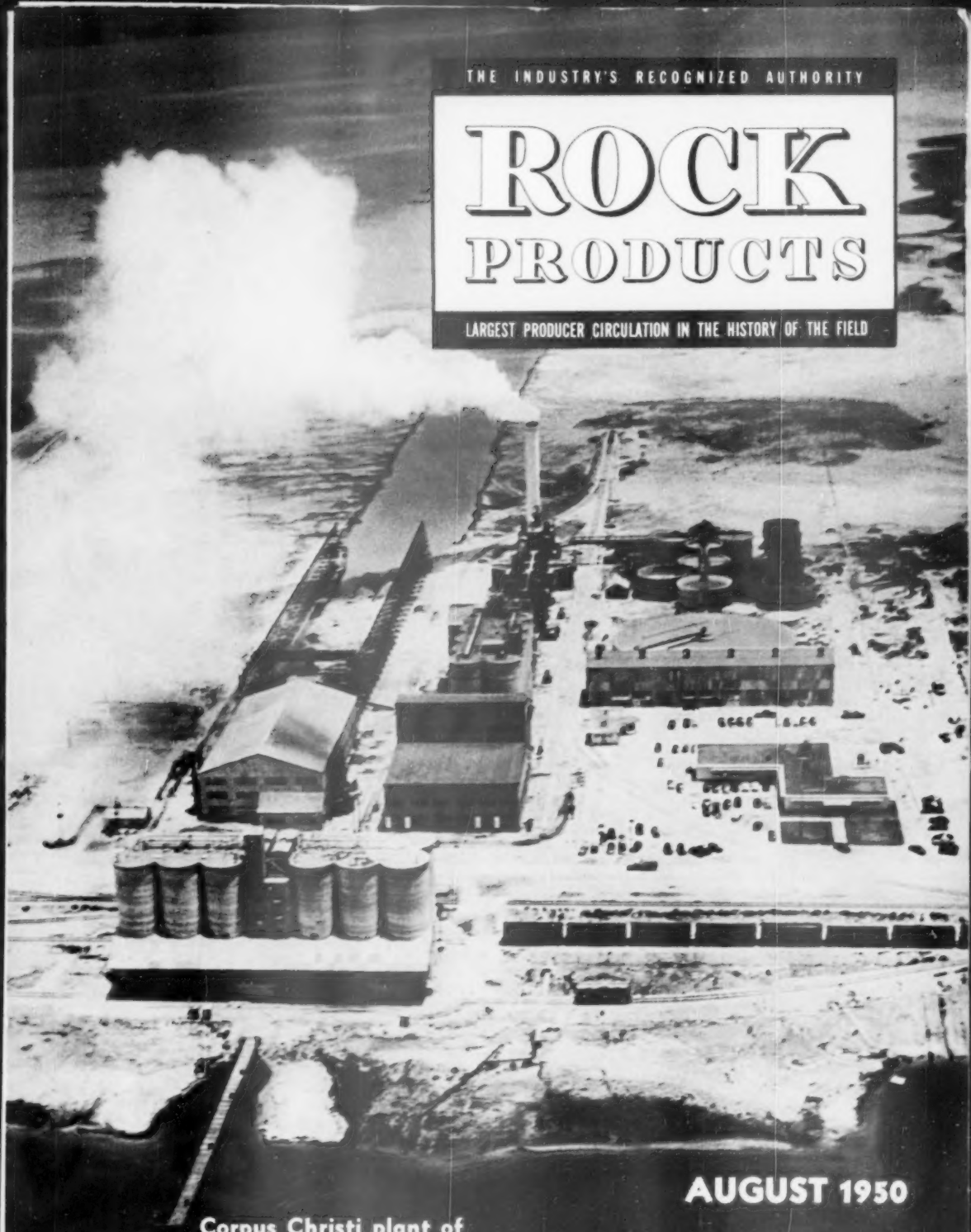


THE INDUSTRY'S RECOGNIZED AUTHORITY

ROCK PRODUCTS

LARGEST PRODUCER CIRCULATION IN THE HISTORY OF THE FIELD

AUGUST 1950

Corpus Christi plant of
Halliburton Portland Cement Co.

ANNUAL CEMENT ISSUE

The ad that failed

...and why!

Proving that Mack trucks outlast them all!

Mack

Mack Trucks, Inc., Empire State Building, New York 1, New York. Factories at Allentown, Pa.; Plainfield, N. J.; New Brunswick, N. J.; Long Island City, N. Y. Factory branches and distributors in all principal cities for service and parts. In Canada: Mack Trucks of Canada, Ltd.

Thanks — but no! "Our fleet comprises 255 motor vehicles and includes 136 Macks, several of which have passed the fifteen-year mark . . . one is in its twenty-fifth year. All are registered and operating profitably. We can see no reason to retire such trucks at this time." C. W. HALL, PRESIDENT, C. E. HALL & SONS, SOMERVILLE, MASS.

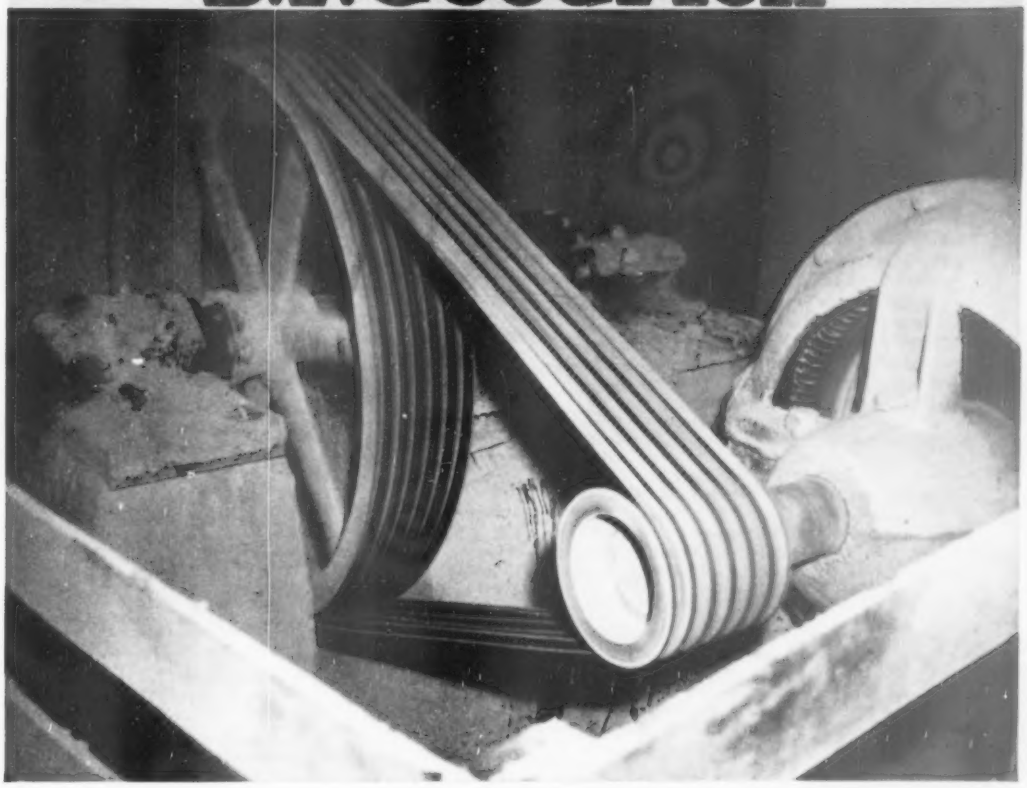
Not trading! "My 1925 Mack still does its share to gross me $5,000 per year in the moving business—and I have spent less than $100 in repairs on this truck in the last 20 years. Obviously, I am not interested in trading." I. V. ASHBY, ASHBY HOUSE MOVING CO., OKLAHOMA CITY.

Will keep! "Our 1934 Mack is still giving good service—it is the oldest of our 30 Macks but still good enough to keep." CLARENCE J. SMITH, SMITH BROS. TRUCK CO., LOS ANGELES, CALIFORNIA.

Still too good! "With reference to your proposal to give us an extra allowance on our Bulldog Mack purchased in 1927—please be advised that this truck is too good to trade in." J. KOLKO, SPEEDWAY WRECKING CO., CHICAGO, ILL.

Trade? not yet! "Forty-two of our trucks are Macks—some of them 27 years old. They outlast any other make and have proved very economical to operate. Not trading yet." JOSEPH CAPECCI, PHILADELPHIA, PENNA.

B.F.Goodrich



Where a change to grommet V belts saved $100 a month

THIS drive turns a ball mill containing 22 tons of steel balls, water and ore that grind until the mineral can be separated. Six ordinary belts weren't enough. They were falling to pieces from overwork.

But there wasn't space to expand, and redesigning the drive would cost $800. Ordinary belts lasted only 5 or 6 weeks, replacement costs were over $100 a month. B. F. Goodrich grommet multiple-V belts were installed, are in their sixth month of service, still in good condition. Here's why the grommet construction reduces V belt costs:

No cord ends — A grommet is endless, made by winding heavy cord on itself to form an endless loop. It has no overlapping ends. Because most of the failures in ordinary V belts occur in the region where cords overlap, the endless cord section in a grommet V belt eliminates such failures.

Concentrated cord strength — All of the cord material in a B. F. Goodrich grommet multiple-V belt is *concentrated* in twin grommets, positioned close to the driving faces of the pulley. No layers of cords to rub against one another and generate heat; cord and adhesion failures are reduced.

Better grip, less slip — Because a grommet is endless, a grommet V belt is more flexible, grips the pulleys better. Size for size, grommet multiple-V belts will give ⅓ more gripping power, pull heavier loads with a higher safety factor.

Only B.F.Goodrich has the grommet! — No other multiple-V belt is a grommet V belt (U. S. Patent No. 2,233,294). At present made in D and E sections only. See your local B. F. Goodrich distributor. Ask him to show you his "X-ray" belt that illustrates grommet construction clearly. *The B.F.Goodrich Company, Industrial and General Products Division, Akron, Ohio.*

Grommet V Belts BY
B.F.Goodrich
FIRST IN RUBBER

ROCK PRODUCTS
AUGUST, 1950 THE INDUSTRY'S RECOGNIZED AUTHORITY VOL. 52, No. 8

Bror Nordberg
Editor

Nathan C. Rockwood
Editorial Consultant

This Month

ROCK PRODUCTS is published monthly by MACLEAN-HUNTER Publishing Corporation, 309 West Jackson Blvd., Chicago 6, Illinois; Horace T. Hunter, President; E. B. Gauley, Vice President; J. L. Frazier, Secretary. Copyright, 1950. Entered as second-class matter, Jan. 30, 1936, at the Chicago, Ill. post office under the act of Mar. 3, 1879. Additional entry at Milwaukee, Wis.
ROCK PRODUCTS is indexed regularly by Engineering Index, Inc.

SUBSCRIPTION INFORMATION

Subscription Price: United States and Possessions, Canada, one year, $2.00; two years, $3.00; three years, $4.00. Pan American, one year, $4.00; two years, $7.00; three years, $10.00. All other foreign, one year, $6.00; two years, $12.00; three years, $15.00. Twenty-five cents for single copies. Indexed in the Industrial Arts Index.
Canadian subscriptions and remittances may be sent in Canadian funds to ROCK PRODUCTS, P. O. Box 100, Terminal "A", Toronto, Canada.
To Subscribers—Date on wrapper indicates issue with which your subscription expires. . . In writing to have address changed, give old as well as new address.

NO HOBSON'S CHOICE

This advertisement, reproduced from Pit & Quarry Handbook, illustrates a very important feature of EASTON's service to the quarry industry—variety of choice. A wide choice of different types of dependable, job-proved quarry transportation equipment helps to protect your haulage investment.

Trailer • Doorless Pan • World famous two-way side-dump for low cost quarry hauling. All-welded. Dumped by *Easton* automatic overhead hoist. Capacities 15-22 tons.

3 BASIC SIDE-DUMPS

TRAILERS or TRUCK BODIES or QUARRY CARS

All three standard basic types are available in a wide range of capacities for earth, rock and ore moving services. EASTON also builds many special smaller units, including skip cars, gravity dump cars, and granby cars. A free transportation survey by experienced EASTON engineers assists the user in selecting the most efficient, most economical type of equipment for his particular requirements. *EASTON trailers and truck bodies are used with all makes of commercial and off-highway trucks and truck tractors.* For prompt attention direct all inquiries to:

EASTON CAR & CONSTRUCTION COMPANY • EASTON, PA.

Trailer • Drop Door • Hydraulic dump or overhead hoist. Automatic down-folding door. All-welded. For versatile earth, rock and ore hauling. Capacities to 40 tons.

Truck Body • Doorless Pan • Two-way reversible side-dump body. All welded. Hydraulic or overhead hoist. For rugged, versatile quarry service. Capacities to 30 tons.

Truck Body • Drop Door • Hydraulic dump, automatic down-folding side door. All-welded. A versatile unit for earth moving, mining, quarrying. Capacities to 30 tons.

Trailer • Lift Door • Dumped by overhead hoist. Side door is lifted to raise body for dumping. All-welded. For heavy duty in mines and quarries. Capacities to 40 tons.

Quarry Car • Doorless Pan • The world-famous *Easton-Phoenix* two-way side-dump quarry car. All-welded construction. Timken bearings. Capacities to 10 cubic yards.

Truck Body • Lift Door • Bale lift door, lifted by overhead hoist, raises body for dumping. Rugged, all-welded for mine and quarry duty. Capacities to 30 tons.

Quarry Car • Drop Door • Automatic down-folding door. Rugged, all-welded construction for mine and quarry service. Timken bearings. Capacities to 10 cubic yards.

EASTON *Side-Dump*

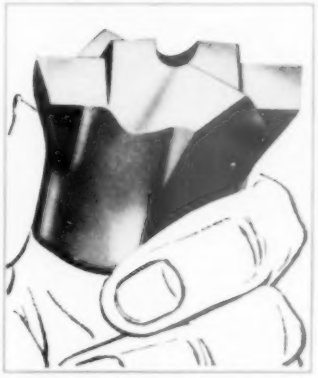
TRAILERS • TRUCK BODIES • QUARRY CARS

B-1041-A

Only TIMKEN® offers all 3 types of rock bits...

1. **MULTI-USE** Basic removable rock bit for 18 years. Gives lowest cost per foot of hole when full increments of drill steel can be drilled and when control and reconditioning of bits are correct. Low cost! Requires less policing than carbide insert bits.

2. **CARBIDE INSERT** For extremely hard and abrasive ground, small holes, extra deep holes. Gives you more drilling time —less time changing bits. Holes go down faster. Reconditioning is simplified. Offers many advantages which compensate for higher unit cost.



3. **ONE-USE "SPIRALOCK"** For use where reconditioning is impractical or undesirable. Offers lowest unit bit cost. New "Spiralock" union holds bit dependably —permits easy removal. Simplifies drill steel preparation. More bit applications per drill steel.

and a complete Rock Bit Engineering Service!

WHICH bit is your best bet? Timken makes *all three* types—multi-use, carbide insert and one-use "Spiralock"—in a variety of series and sizes. And to help you choose the one bit that's best for your job, Timken offers a *complete* Rock Bit Engineering Service. Timken has been solving rock bit problems for over 17 years and our Rock Bit Engineering Service is qualified to help solve your problem. Whether you're looking for lower bit cost, lowest cost per foot of drilled hole, greatest possible drilling speed or any other advantage, our engineers, with *all three* types of rock bits to draw upon, can find the answer for you.

The Timken Rock Bit Engineering Service is at your disposal. For information and help, contact The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO".

TIMKEN

... your best bet for the best bit ... for every job

FREE BOOKLET: *Everyone who buys rock bits should have a copy. Gives full information on all three types of Timken rock bits and the Timken Rock Bit Engineering Service. Shows full line of bits in actual-size photographs, with detailed descriptions. Write The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO".*

You can't keep up with a GOOD ROCK SHOVEL!

Even the advertising can't keep up with it. Before the reproduced ad had been completed and run, Bryan Rock & Sand Co. of Raleigh, N. C. had eight more Northwests in service.

Northwest owners have found that when you begin with a real rock shovel you finish the job on time. That is why one out of every three Northwests sold is a repeat order in the hands of a responsible contractor.

Northwest advantages and Northwest design make possible the kind of service you are looking for. Check with Northwest users. Ask about the "Feather-Touch" Clutch Control, Uniform Pressure Swing Clutches, the Cushion Clutch, the Northwest Dual Independent Crowd, Northwest Steering and other features that make upkeep costs low and assure high output. Talk to our sales agent and get full details. If you have never had a Northwest you'll find that your first Northwest will be our best salesman.

NORTHWEST ENGINEERING COMPANY
135 South LaSalle Street
Chicago 3, Illinois

only the best for the heart of the job
MAKE YOUR KEY MACHINE A NORTHWEST CRAWLER CRANE
PROFIT

NORTHWEST

Convertible for any Mining Material Handling or Excavation Problem

ALLIS-CHALMERS

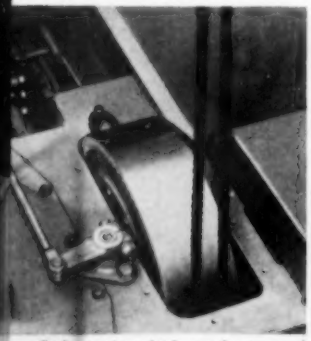
Design Simplicity

Another Big Reason Why HD-5 Leads In Tractor Output

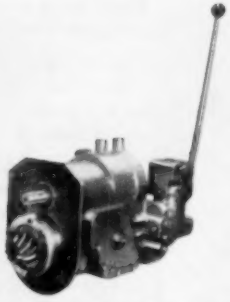
Simple unit assembly is another important reason why the HD-5 is low in total down time required for servicing and maintenance — why it is tops in output per day, per month, per season.

When maintenance is necessary, each assembly is readily accessible for attention. The HD-5 is designed so that each major unit may be easily removed and repaired or replaced *right on the job* without removing unrelated parts. The time and labor saved means substantial increases in the HD-5's over-all output. Remember — a tractor makes money for an owner only when it's working.

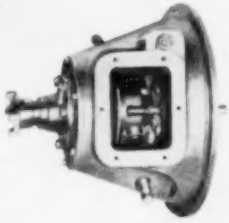
Get the full time-saving service story on the more simply designed HD-5 from your Allis-Chalmers dealer . . . NOW! Ask him, too, for a practical demonstration . . . a demonstration under your own operating conditions. "Seeing Is Believing."



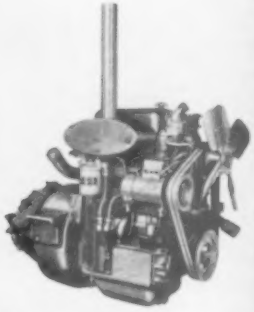
Each steering clutch can be removed independently and without removing final drive pinion or bevel gear.



Transmission can be removed as a complete unit without removing clutch, final drive or bevel gear.

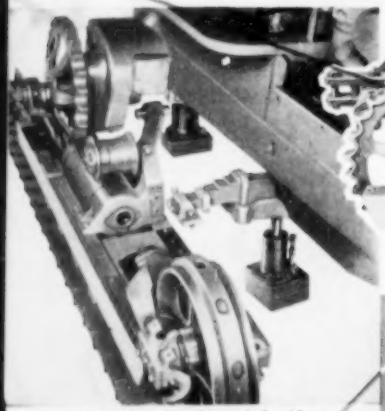


Clutch assembly can be removed without disturbing engine or transmission.



Engine can be removed without disassembling clutch.

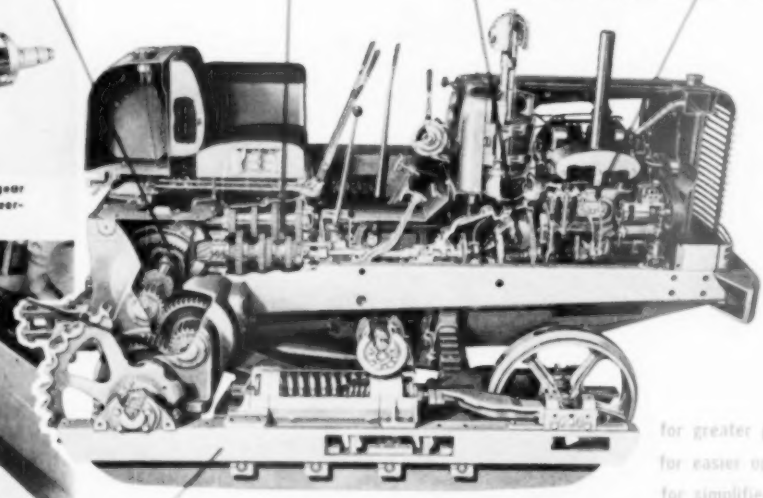
Final drive gear and intermediate gear can be removed without disturbing steering clutch.



Truck frame can be dismantled without removing final drive, sprocket or equalizer spring.

MORE REASONS FOR HD-5 TOP PERFORMANCE

- Exclusive Positive Seal 1,000-Hour Lubrication of truck wheels, track idlers and support rollers
- 11,000 lb. of Balanced Weight
- Greater Operator Comfort
- 2-Cycle Diesel Engine — 40.26 drawbar hp.



for greater production
for easier operation
for simplified servicing

ALLIS-CHALMERS

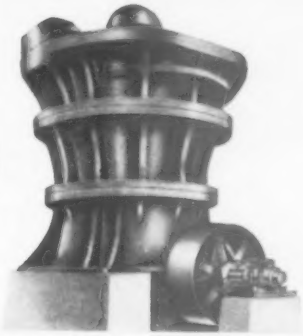
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

Traylor

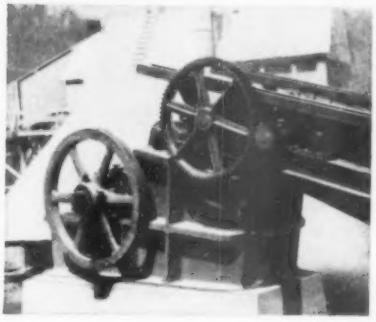
WRITE FOR BULLETIN 3121 TODAY

MACHINERY FOR CEMENT PLANTS

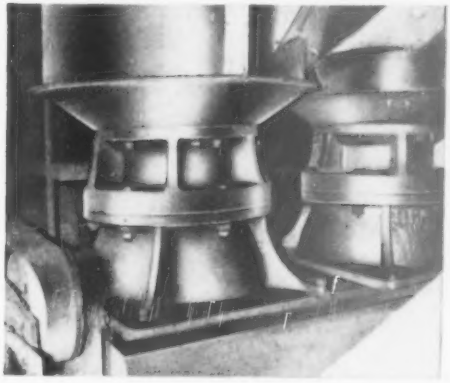
. . . designed for lower cost operation, greater dependability and closer product quality control.



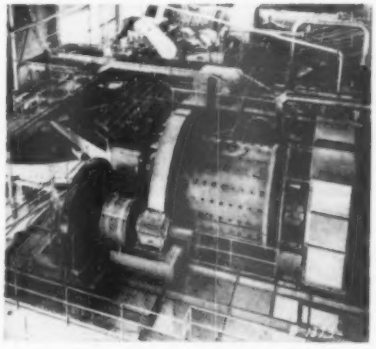
For Primary Crushing in huge quantities, a favorite item of equipment is the Traylor Bulldog Gyratory Crusher like this 54" model which Traylor built for a cement plant in Montreal, P.Q. and one in Great Britain.



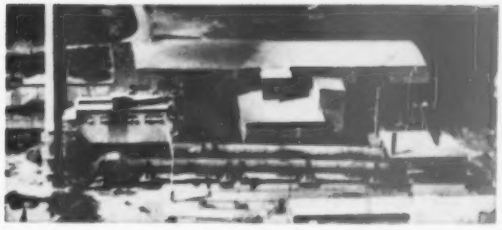
Lesser volumes can often be most profitably crushed with a Traylor Jaw Crusher such as the Type H shown here with a Traylor All Steel Apron Feeder to provide absolute feed control.



For Reduction Crushing, the Traylor TY, with its exclusive bell head and curved concaves, has an extremely favorable output-to-horsepower ratio. This is one of a pair employed in a California cement plant.



Traylor Ball Mills were installed for both raw and finished grinding when this plant was built in 1948 at Portland, Colorado. This company has a total of 27 Ball Mills in operation at plants in Colorado, Alabama and Utah.



This picture shows a 9'6" x 250' Traylor Rotary Kiln and Tube Cooler operating in a modern cement plant at Okay, Arkansas. A new plant built by this Company includes four 10' x 400' Traylor Rotary Kilns.

Traylor

Rotary Kilns, Coolers and Dryers
Grinding Mills . Crushing Rolls
Jaw, Reduction and Gyratory Crushers

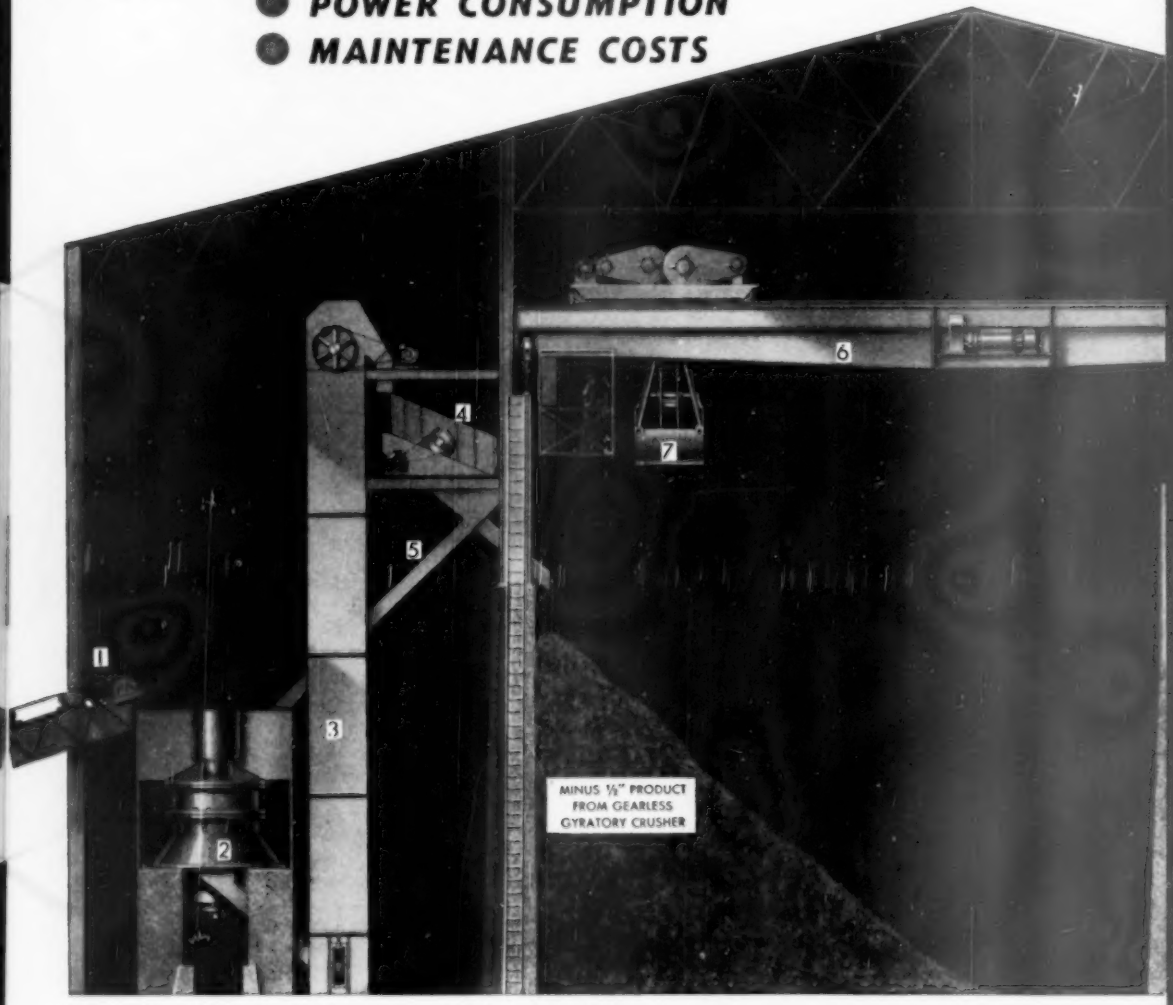
TRAYLOR ENGINEERING & MANUFACTURING CO.
176 Mill St., Allentown, Pa.

Sales Offices: New York, N. Y., Chicago, Ill., Los Angeles, Calif.
Canadian Mfrs: Canadian Vickers, Ltd., Montreal, P. Q.

A "TRAYLOR" LEADS TO GREATER PROFITS

KENNEDY STRATIFIED AIR SWEPT

LOWERS
- **GRINDING COSTS**
- **POWER CONSUMPTION**
- **MAINTENANCE COSTS**



1 BELT CONVEYOR — FEED TO CRUSHER
2 GEARLESS GYRATORY CRUSHER
3 ELEVATOR
4 VIBRATING SCREEN
5 OVERSIZE RETURN CHUTE
6 TRAVELING CRANE
7 CLAMSHELL BUCKET
8 MILL FEED HOPPER
9 WEIGHING FEEDER
10 STRATIFIED AIR SWEPT TUBE MILL
11 RADIAL FLOW CLASSIFIER
12 CYCLONE COLLECTOR
13 MILL EXHAUSTER
14 DUST FILTER
15 DUST FILTER EXHAUSTER
16 ROTARY AIR LOCKS
17 FINISHED MATERIAL CONVEYOR
18 AUTOMATIC PNEUMATIC TRANSPORT PUMP

THIS UNIT PRODUCED 94% PLUS THROUGH

KENNEDY-VAN SAUN MFG. & ENG. CORPORATION

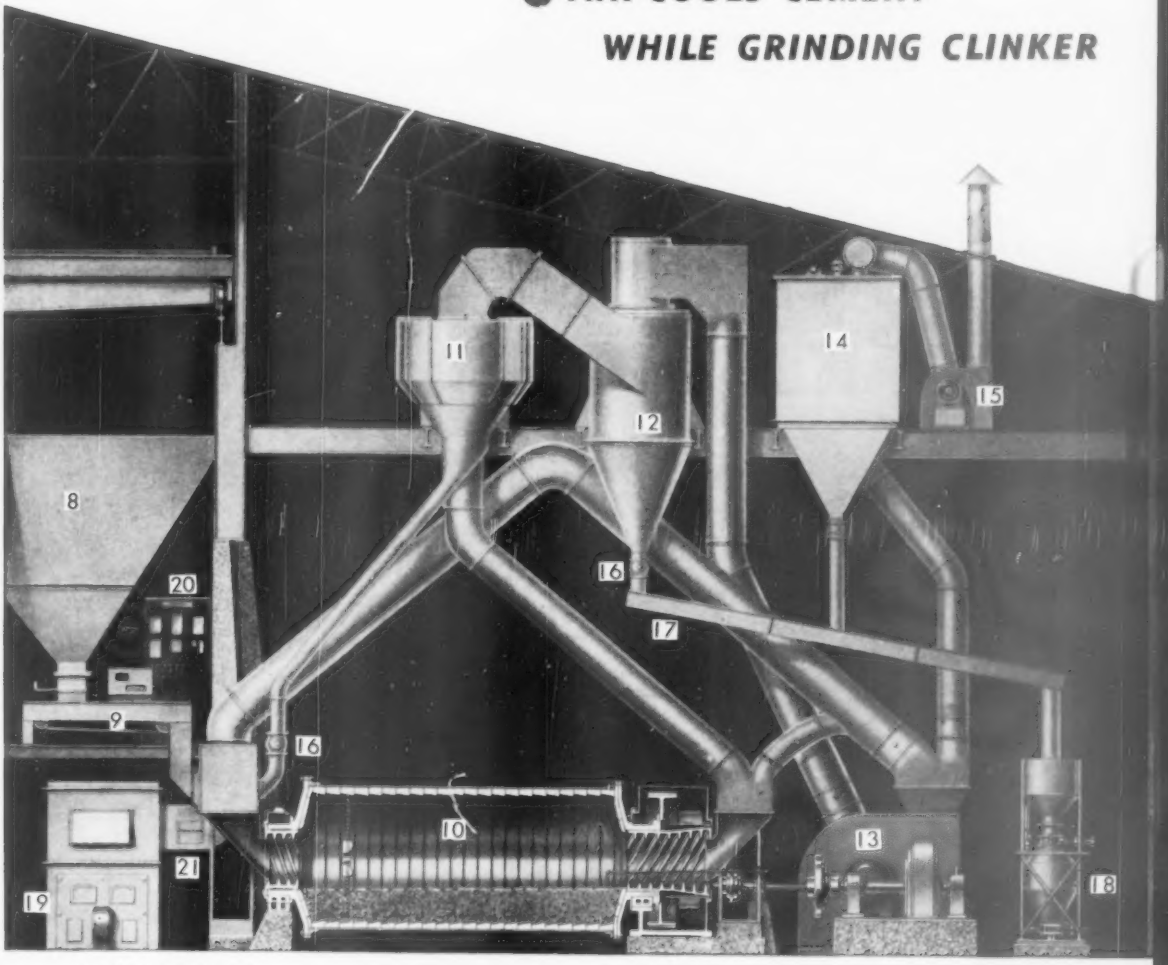
TUBE MILL SYSTEM

Patents Pending

FOR RAW STONE, ORE AND CLINKER GRINDING

● DRIES AND GRINDS SIMULTANEOUSLY

● AIR-COOLS CEMENT WHILE GRINDING CLINKER



19 HOT AIR FURNACE
20 INSTRUMENT AND CONTROL CUBICLE
21 AUTOMATICALLY CONTROLLED TEMPERING AIR DAMPER

FINISHED MATERIAL TO STORAGE SILO

● ASK FOR ONE OF OUR ENGINEERS TO CALL

325 MESH WHEN GRINDING CLINKER 2" AND FINER

2 PARK AVENUE • NEW YORK 16, N. Y. FACTORY: DANVILLE, PA.


IT TAKES MORE

Yes, meeting contract deadlines depends on *many* factors...and one of the most important is the *quality of the lubrication* your machines get. For lubrication is more than just "oils and greases"...it's also knowledge of your equipment, the right lubricants to use for it, and how to use those lubricants to best advantage.

That's why you'll do better with Socony-Vacuum *Correct Lubrication*. It's a *complete* program of lubrication—designed specifically for your equipment and operating conditions to step up efficiency, speed work-progress, reduce both maintenance and lubrication costs.

Why not enjoy *all* the benefits of *Correct Lubrication?* Call your Socony-Vacuum Representative today!

THAN CLOCK-WATCHING *to STAY on SCHEDULE!*

Here's Practical Help for Contractors . . .

Socony-Vacuum gives you quality lubricants *plus*...

- Practical help on all maintenance problems.
- Individual, tested lubrication schedules.
- Advice on correct application of lubricants, and on proper handling and storing.
- One source of supply—available everywhere.
- Simplified inventory—with...

1. **DELVAC OILS**—for gasoline and automotive-Diesel engines.
2. **MOBILUBE GX**—multi-purpose gear lubricant for all enclosed gears—manually operated transmissions, drive axles and final drives.
3. **MOBILGREASE MP**—multi-purpose grease for all chassis parts and engine accessories.

CORRECT LUBRICATION

SOCONY-VACUUM

for Contractors

THE FLYING RED HORSE COMPANIES:
SOCONY-VACUUM OIL COMPANY, INC.
MAGNOLIA PETROLEUM COMPANY
GENERAL PETROLEUM CORPORATION

"Parts reach us in a few hours' time"

Arthur R. Alvis, quarry plant owner near Butler, Mo., likes his "Cat" D4 Tractor with Tracxcavator. "It's easier on dump trucks and keeps the area smooth and clean."

THAT's what Arthur R. Alvis, owner of a quarry near Butler, Mo., thinks of "Caterpillar" dealer service. But it's only one reason why he standardizes with "Caterpillar" power and equipment. He knows that "Cat" machines and engines are quality-built to work together for more production at less cost. "We've gotten along better with 'Cat' equipment than any other we've had," he sums up.

Under severe dust conditions, Mr. Alvis relies on a "Cat" D375 Diesel Engine to drive a Universal Pulverizer No. 4—36" x 26" at his stationary crushing plant. He uses a "Cat" D8300 Diesel to drive a 20" x 26" jaw crusher. And a D8300 self-regulated "Cat" Electric Set furnishes the auxiliary power for his whole plant. "Caterpillar" Diesel Engines deliver bonus power at the lowest total cost. Advanced design and quality materials are part of the answer. But another reason for their long-haul economy is the fact they're *reasonably* rated. Because they don't have to risk a mechanical hernia to produce their hp. rating, frequent overhauls and costly breakdowns are avoided, cutting maintenance costs to the bone.

Mr. Alvis' matched equipment gives him matchless performance in processing lime for farmers in surrounding counties, and rock in road sizes for county townships and contractors. He specializes in surfacing stone, concrete rock, buckshot chips and asphalt mixes. And he knows that his one-dealer "Caterpillar" service will get him quick action any time, anywhere. Why not ask the "Caterpillar" dealer in your territory to show *you* how these power-rated yellow engines and machines can increase your profits?

CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS

This D375 "Cat" Diesel Engine weathers the severe pounding and dust conditions of quarrying in driving a Universal pulverizer at the Alvis stationary crushing plant. In background, a D8800 "Cat" Diesel powers a Universal jaw crusher. This plant handles 80 tons of agricultural lime or 125 tons of road rock per hour. Other "Caterpillar" equipment on the job, for more profitable production, includes a "Cat" D7 Tractor with 'Dozer to handle overburden, and a "Cat" D4 Tractor with Traxcavator for loading rock.

All auxiliary power is furnished by this D8800 self-regulated "Cat" Electric Set. This reliable unit stands by and delivers hour after hour, day after day—powering one 30" and five 24" Universal conveyors . . . a 500-amp. P&H Welder . . . and lights, small tools and screens.

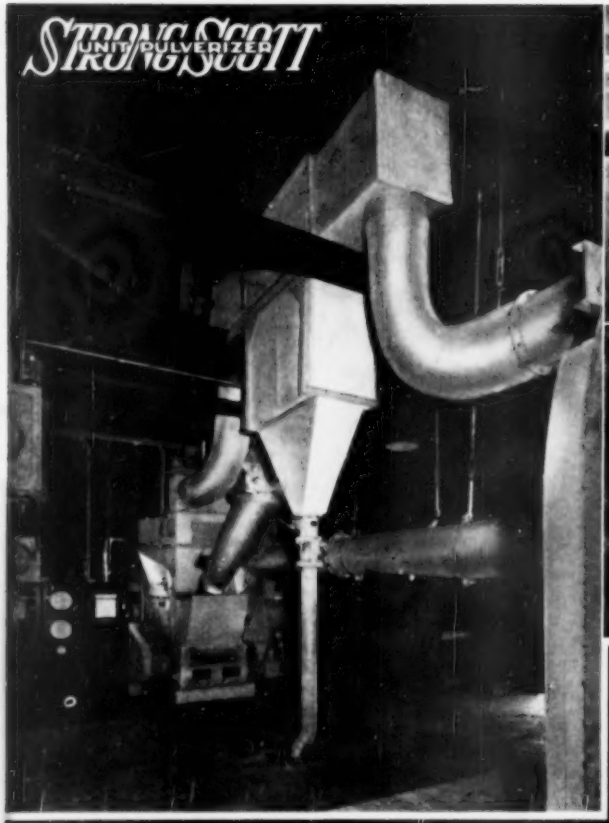
LOOK UNDER THE HIDE

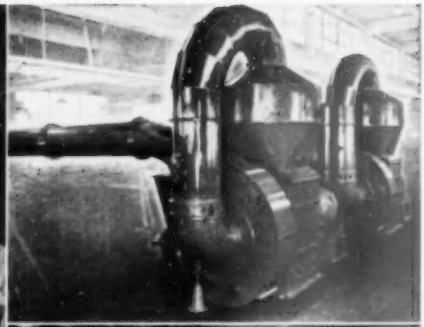
Fuel pumps are "Caterpillar"-designed and "Caterpillar"-built. Made of the cleanest high-chromium, high-carbon alloy steel obtainable, the pump plungers and barrels are diamond lapped. Pumps are heat treated to maximum hardness to give users thousands of hours of trouble-free economical service. There is an individual pump for each cylinder. Pumps are adjustment-free and completely interchangeable. Look under the hide for quality that pays off in performance.

CATERPILLAR

REG. U. S. PAT. OFF.

DIESEL ENGINES • TRACTORS • MOTOR GRADERS • EARTHMOVING EQUIPMENT

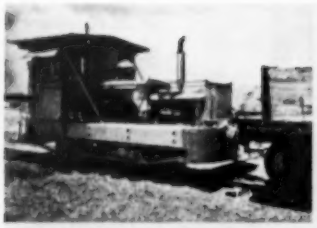




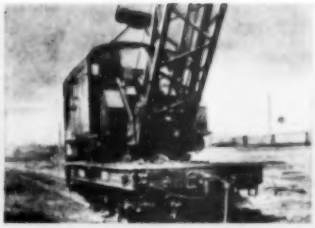
***STRONG-SCOTT PULVERIZER** is equally suitable for direct-firing kilns or driers, waste-heat or direct-fired boilers and is sufficiently flexible to permit its being applied to one or the other at will. Its adjustments also permit the use of a wide variety of fuels, and it will handle any bituminous coal mined in North America . . . regardless of moisture content. With uniform feeding, uniform grinding, uniform product passing from the classifier, and uniform secondary air mixture, all under easy control, it is possible to control flame **TEMPERATURE**, flame **LENGTH**, and flame **VOLUME**. This ability to put the heat **WHERE** you want it—and **WHEN**—is a feature that will appeal to every operator of a rotary kiln or dryer. **STRONG-SCOTT** Pulverizers are operating in some of the best-known cement and lime plants in the country . . . our engineers will gladly help you solve your **BURNING** or **DRYING** problems.*

THE STRONG-SCOTT MFG. CO.

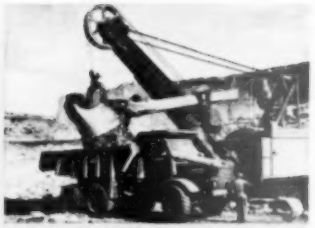
N. W. Terminal · Minneapolis 13 · Minnesota



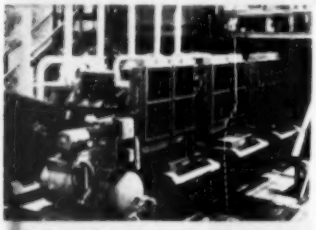
LOCOMOTIVES—Repowered with GM Diesel Torque Converter unit, this 20-ton locomotive hauls double the tonnage without ever shifting into low gear.



HOISTING—Converted from steam to GM Diesel Torque Converter power—estimated operating savings will pay repowering and overhaul cost in less than two years.



EARTH MOVING—Two 190 H. P. GM Diesel Torque Converter units give 34-ton Euclid 1-FFD rear dump a speed of 25.4 m.p.h. with full load.



DRILLING—"½ faster than with original engines," says owner of rig repowered with 3 GM "Twin" Diesel Torque Converter units.

LOGGING—Powered with GM Diesel Torque Converter unit, this Washington Iron Works yarder has yarded 140,000 bd. ft. per day.

WRITE FOR YOUR COPY
of 24-page illustrated catalog giving full details on design, operation and application of "The NEW General Motors Diesel Engine-Torque Converter Unit."

How to Get *MORE WORK* from your Equipment

Operators in every field report they get more work done in less time at lower cost with equipment powered by General Motors Diesel Engine-Torque Converter units.

The combination of a GM Diesel engine with an integrally built torque converter and fluid coupling provides a compact power unit which makes available maximum engine horsepower and torque regardless of the speed of the load. It delivers high torque for starting heavy loads and *automatically* shifts to fluid coupling when load requirements equal engine torque. Gear shifting is cut to a minimum—often eliminated. Smooth transmission of power through a fluid, protects both engine and driven machinery from sudden shock loads—prevents engine stalling under any load condition.

These efficient Diesel Engine-Torque converter units are available with 3-, 4-, and 6-cylinder engines, Twin 4 and Twin 6 multiple engines, rated at 64 to 294 B.H.P. See your GM Diesel distributor or write us for further information.

DETROIT DIESEL ENGINE DIVISION

SINGLE ENGINES . . . Up to 275 H. P. **DETROIT 28, MICHIGAN** MULTIPLE UNITS . . . Up to 800 H. P.

GENERAL MOTORS

GM GENERAL MOTORS DIESEL POWER

DIESEL BRAWN WITHOUT THE BULK

BELT CONVEYORS

CUT ROCK HANDLING COSTS

For handling sand and gravel and rock products in large or small volumes, the Belt Conveyor is still the fastest, most convenient and most economical method. Here's a typical example of Belt Conveyor application where a modest investment provided satisfactory equipment to fill a definite need.

Since 1901 Stephens-Adamson has designed and manufactured Belt Conveyor equipment for countless rock producing plants as well as for every other branch of industry. S-A engineers are especially skilled at assembling conveyors, feeders, screens, elevators and related equipment into smooth-working, high-capacity handling systems. Write us for full details . . . no obligation.

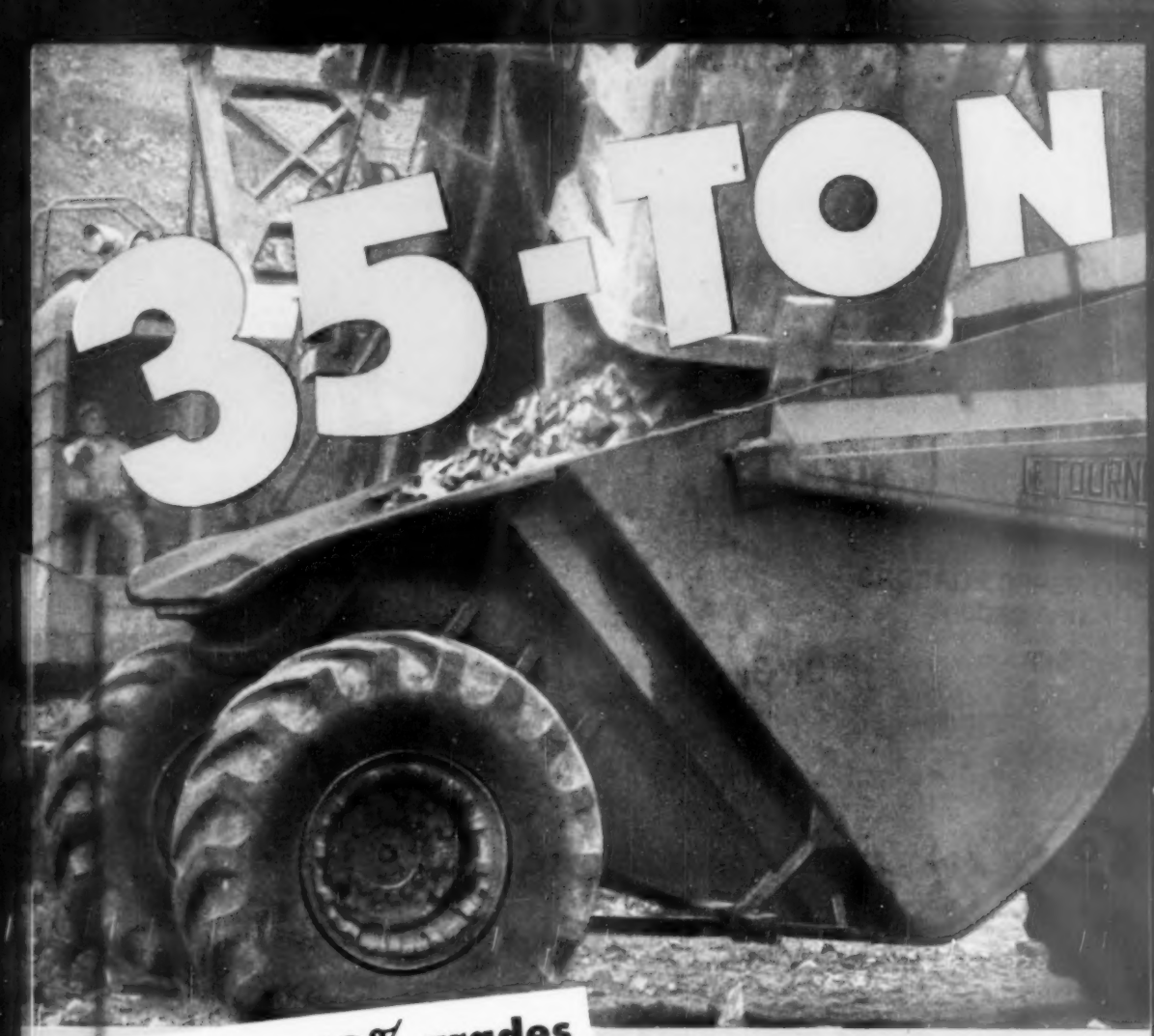
HARRY T. CAMPBELL SONS' CORP.
Texas Quarry, Towson, Md.

Quarried rock is delivered by truck from point of operations in the quarry to a primary slugger-roll crusher. After reduction to 8 in. or finer it is conveyed and lifted 135 ft. by 36" wide S-A inclined belt conveyor to the upper sizing plant and secondary crusher. Experience reveals that this system delivers a continuous, or intermittent, flow of primary crushed rock in required volume . . . and does so at minimum cost per ton.

STEPHEN S-A DAMSON MFG. CO.

7 Ridgeway Avenue, Aurora, Illinois — Los Angeles, Calif. • Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT



Hauling up 10% grades ...loads weigh 37½ tons

On bench stripping operations at their Bagdad, Arizona mine, the Bagdad Copper Corporation brought in two 35-ton, rear-dump Tournarockers . . . teamed them with a 4-yard shovel . . . and report the following big-tonnage results:

Each big-capacity LeTourneau rear-dump rock wagon is loaded with 6 to 7 passes from the well-heaped 4-yard dipper in less than 2 minutes . . . and, according to actual weight test, loads carried average 37½ tons. Hauling these oversize loads along narrow benches . . . down 10½% grade for 450 feet . . . then, up 660 feet at 10%, each Tournarocker averages a 4510-foot round trip every 11.2 minutes, including load, haul, dump and return. Giant, 4-wheel air brakes, and positive electric power steer let operators haul in 3rd gear along the benches with complete confidence and safety. On the 10% mine grades, Tournarockers climb easily in second, with full loads. Pull is exceptionally smooth because of power-proportioning differential, which automatically delivers 4 times the power to drive wheel on firmest footing.

On the spoil bank, these husky haulers also show a lot of speed advantages, 90° turns, controlled by push-button electric steer, give fast, easy spotting. Power on front drive wheels lets Tournarocker back up clear to edge and dump over bank . . . eliminates most clean-up. Simple electric

LETOURNEAU PEORIA, ILLINOIS **TOURNAROCKERS**

HIGH SPEED on RUBBER PLUS TRACTION ADVANTAGES of a CRAWLER

TOURNAROCKERS Speed Stripping for Bagdad Copper

PUTS LOAD OVER EDGE OF BANK

In dump position, back end of Rocker body is below rear wheels . . . bowl rests on edge of bank . . . loads dump clear. Positive holding action of big 4-wheel, disc-type air brakes makes this operation safe. With power on front wheels, drivers are always on firm footing for quick, easy pull-away from edge.

hoist raises body to vertical position . . . smooth, streamlined bowl clears the 37½-ton loads in an average of 38 seconds, total hoist and dump time!

Sizes: 50, 35, 16, 9 tons

Like Bagdad Copper Corporation, it will pay you to investigate the big tonnages and new low hauling costs possible on your work with these revolutionary, rear-dump rigs. Remember, too, with every size Tournarocker . . . 50, 35, 16 or 9 tons . . . you have money-saving interchangeability with Carryall scrapers, cranes, flat-beds and many other auxiliary hauled units. That assures greater operating flexibility and steady earnings the year round! Your LeTourneau Distributor has all the facts . . . call him for more information . . . write NOW.

Tournadozer, Carryall, Rooter—Trademark Reg. U.S. Pat. Off. Tournarocker—Trademark M25

BAGDAD COPPER ALSO USES TOURNADOZER

Rubber-tired Tournadozer is Bagdad Copper Corporation's high-speed handyman. Its 180 "horses" on 21.00 x 25 tires give quick, "run-anywhere" service for clean-up around the shovel, haul road maintenance. Rear-mounted PCU makes it readily available for use with 4-wheel scraper, Rooter, or other cable-operated tools.

Mail today to: **R. G. LeTOURNEAU, INC., Peoria, Illinois**

Send us specs., price and performance data on ☐ 50 ☐ 35 ☐ 16 ☐ 9-ton Tournarockers. ☐ Also send facts on 186 h.p., rubber-tired Tournadozer.

NAME _____ TITLE _____

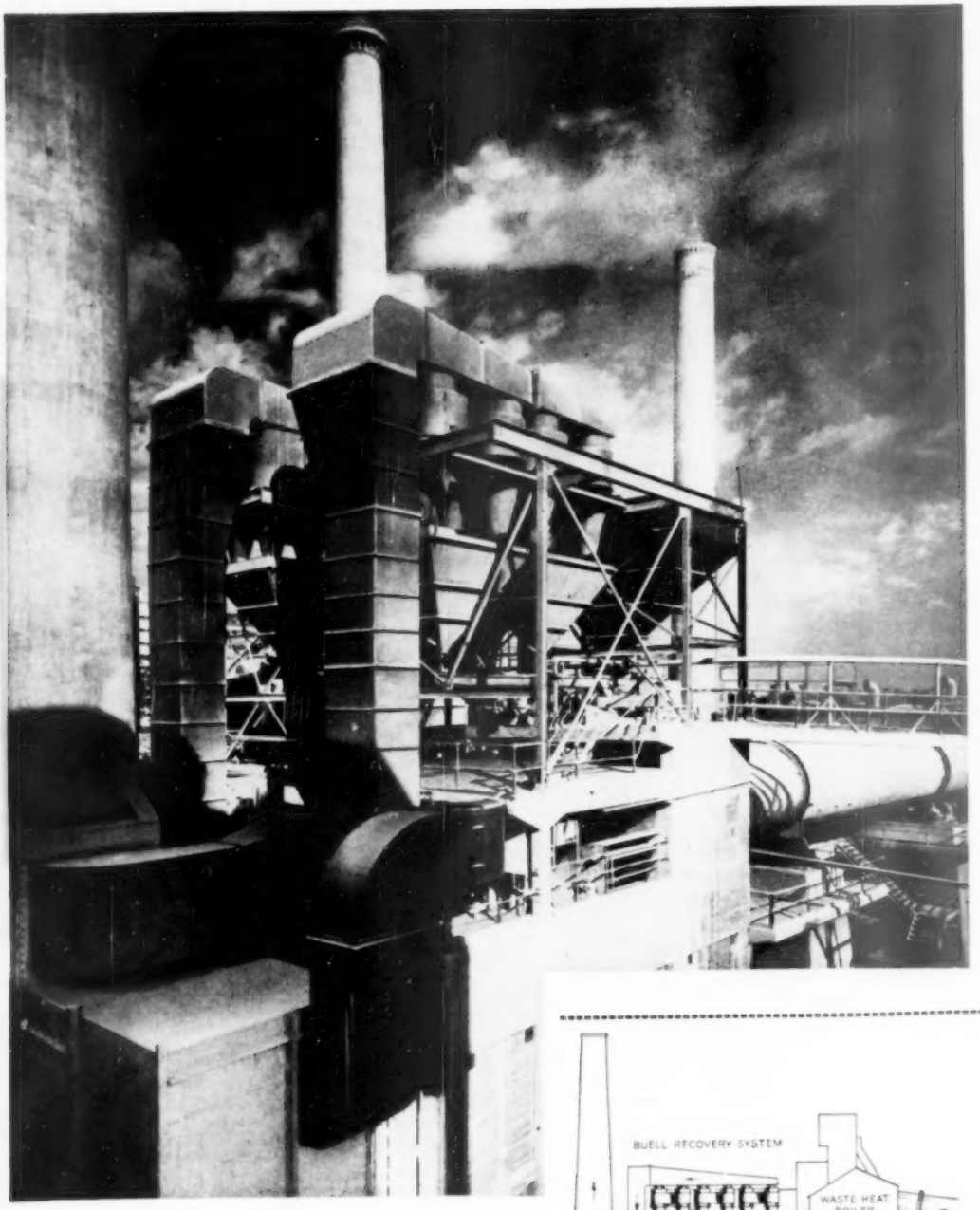
COMPANY _____ Dept. or Div. _____

STREET _____

CITY _____ STATE _____

LeT

In Cement and Lime Kiln



MILLION TON TORTURE TEST

...READY FOR MORE!

QUAKER CONVEYOR BELTING

PERFORMANCE-PROVED TO GIVE LONGER SERVICE

Day in day out . . . year after year . . . for eleven years more than a million tons of rock smashed down and was carried along by a Quaker Ironsides Conveyor Belt. This 24" wide belt takes an impact drop of four feet and runs on a grade that starts four feet off the ground to a height of fifty-five feet . . . carries 60 to 100 yards of material per hour. After a million tons, it is still good and ready for many more.

Whatever your belting need in hauling rock, sand, gravel or aggregates . . . flat transmission belts, V-belts or conveyor belts, you can rely on Quaker for long performance-proved service. Every belt built by Quaker is thoroughly pre-tested in the plant . . . every type has been performance-proved on the job. To economize on belting, you'll find it pays to Quakerize your operations.

QUAKER PACKINGS FOR SAFER SEALS

Scientifically pre-tested . . . ruggedly performance-proved Quaker Packings are engineered for every use in the rock products industry—for pumps, compressors, water, air or steam lines, and many other places where a positive, long lasting seal is a "must."

QUAKER HOSE FOR RUGGED WEAR

Pre-tested for flexibility and strength . . . built to stand abrasion . . . performance-proved for rugged resistance to . . . wear every Quaker Hose has been scientifically developed for specific applications that will give longer service on rock drills, water lines, oil lines and the conveying of volatiles.

QUAKER RUBBER CORPORATION · PHILADELPHIA 24, PA.

Division of H. K. Porter Company, Inc.

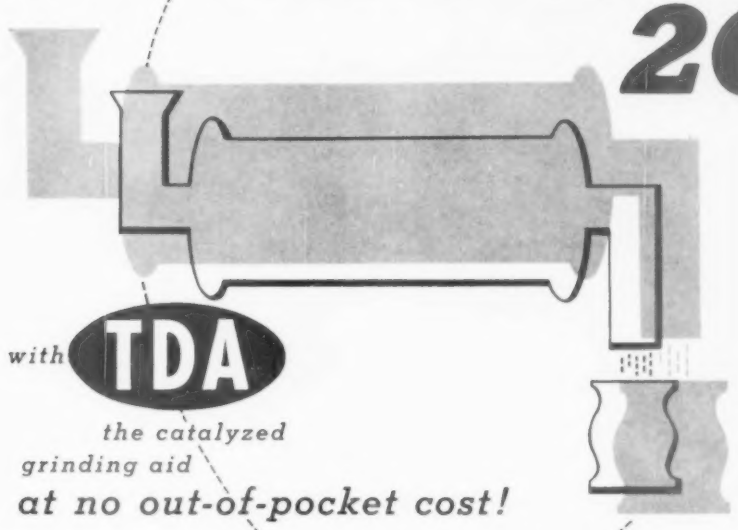
Pittsburgh • New York • Cleveland • Chicago • Houston • Atlanta

Western Territory

QUAKER PACIFIC RUBBER CO. • San Francisco 10 • Los Angeles 21 • Seattle 4

QUAKER RUBBER PRODUCTS *custom made for every industrial use*

increase your cement-mill capacity 20%



with **TDA**

the catalyzed grinding aid

at no out-of-pocket cost!

With TDA, you can in effect increase the size of your cement-grinding mill, **with no capital expenditure,** because

TDA increases the rate of grinding of your present mill

TDA reduces your grinding costs per barrel of cement

TDA guarantees most efficient mill performance

TDA works well not only with all types of portland cement, but also with puzzolanic and natural cements. Its cost is amortized as you use it. TDA pays its own way – in increased production. Let our engineers show you how to get more production, and a quality product, from your cement mill . . . at no out-of-pocket cost.

Dewey and Almy research-engineered products for the construction and paving industries:

Write today for technical information and prices.

DEWEY and ALMY
Chemical Company

Cambridge 40, Mass. Chicago 38
San Leandro, Calif. Montreal 32

TDA – *grinding aid*
SRDA – *retarder and plasticizer*
RDA – *raw materials grinding aid*
MRDA – *retarder*
DAREX – *air entraining agent*
DARASEAL – *membrane curing compound*
DARAPHANE – *water proofing compound*
DARAKOTE – *anti-stripping additive*
AIRALON – *air entraining agent*

"KNOW HOW"
THE KEY TO SUCCESSFUL PERFORMANCE

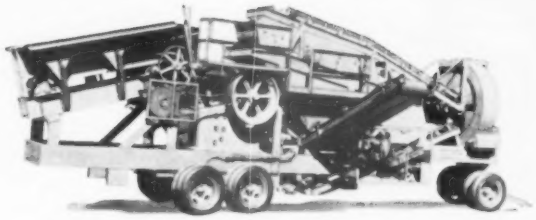
Aerial view of a wet process plant at Portland, Colorado, designed and constructed by the Stearns-Roger Manufacturing Company according to specifications of the Ideal Cement Company. This plant has a daily production capacity of 4,000 barrels.

Stearns-Roger construction facilities are adequate for any size project—and round out a service which "begins at the drawing board." The "know how" required in projects of this type enables Stearns-Roger to take undivided responsibility in a complete service including: engineering, designing, manufacturing, construction.

Stearns-Roger

THE STEARNS ROGER MFG. CO. DENVER, COLORADO

4 TOP PRODUCERS THAT INVITE COMPARISON



1 TwinDual Pacemaker Rock Plant

2 TwinDual Gravel King—three stages of crushing, two screens for pits with large boulders

3 TwinDual Master Gravel Plant—double the output of conventional two-stage plants of comparable size and weight

4 TwinDual Secondary with 546P Primary. High capacity with two portable units for quarry operation

UNIVERSAL'S TWINDUAL PLANTS FOR ROCK AND GRAVEL

Out in front! Universal TwinDual Plants are breaking production records and cutting costs per ton on finished aggregate.

Universal "Stream-Flo" engineering does it with the TwinDual Method—the modern system of crushing and screening that gives three full stages of reduction with only two crushers. You get more production, less jaw and roll shell wear, longer life, less maintenance.

Before you make an investment in a crushing, screening and loading plant for rock or gravel investigate the profitable bonus you get with a TwinDual installation. Compare TwinDual Plants with the field. Get the facts now.

How many crushers do you need for 3 full stages of reduction?

The TwinDual Method does it with two—
First Stage—Jaw Crusher
Second and Third Stages—TwinDual Rolls

UNIVERSAL ENGINEERING CORP. division of PETTIBONE MULLIKEN CORP.

617 C Ave., N. W., Cedar Rapids, Iowa
Phone 7105

4700 W. Division St., Chicago 51, Illinois
Phone SP aulding 2-9300

NEW IMPROVED DESIGN

JEFFREY BUCKET ELEVATORS

- Welded Angle Casings —heavy gauge steel Dust tight—Water tight
- Improved Head and Boot Sections
- Increased Bearing Protection
- Removable Hood
- Large Clean-out Doors both sides
- Large Inspection Doors for access to chain and buckets
- Take-ups furnished for Head or Boot if desired—self-aligning, plain or anti-friction bearings

Chains • Conveyors of all kinds • Feeders • Car Pullers • Bin Valves • Dryers and Coolers • Packers • Skip Hoists Screens • Crushers and Pulverizers Belt Idlers • Transmission Machinery Replacement Parts

- These are only some of the features incorporated in our Standard Bucket Elevator line. A type and size to meet any requirement. Complete drawings available. Jeffrey Bucket Elevators are backed by years of engineering experience and hundreds of installations. May we hear from you?

THE JEFFREY MANUFACTURING COMPANY Established 1877

939 North Fourth St., Columbus 16, Ohio

Complete Line of Material Handling, Processing and Mining Equipment

Baltimore 2	Chicago 1	Detroit 13	Jacksonville 2	Pittsburgh 22
Birmingham 3	Cincinnati 2	Harlan	Milwaukee 2	St. Louis 1
Boston 16	Cleveland 13	Houston 2	New York 7	Salt Lake City 1
Buffalo 2	Denver 2	Huntington 19	Philadelphia 3	Scranton 3

Jeffrey Mfg. Co., Ltd., Head Office & Works, Montreal

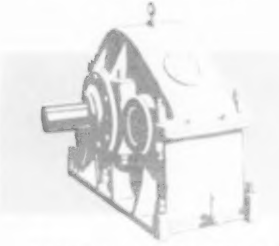
Quick Reference Guide

to improved lubrication and lower maintenance costs for quarry equipment

GULF PRECISION GREASE — high quality sodium soap grease for ball and roller bearings operating at high speeds. Recommended for many shaker screen bearings.

GULF ROCK DRILL OIL — prevents gumming and rusting in air operated tools. Protects against excessive wear.

GULFLUBE MOTOR OIL H.D. — heavy duty detergent type oil for lubrication of Diesel engines. High quality, yet economical. Paraffin base, Multi-Sol Processed.



GULF E. P. LUBRICANTS — better protection for heavily loaded enclosed gear drives — good water separating characteristics.

GULF HARMONY OIL — ideal for compressor cylinders and bearings — reduces wear, corrosion.

GULF has the right lubricant for every type and size of crusher—ask a Gulf Lubrication Engineer for his recommendation.

It will pay you to investigate their application in your equipment... *Call in a Gulf Lubrication Engineer today!*

Gulf Oil Corporation · Gulf Refining Company
GULF BUILDING, PITTSBURGH, PA.
Sales Offices - Warehouses
Located in principal cities and towns throughout Gulfs marketing territory

GULF INDUSTRIAL LUBRICATION

NORDBERG MACHINERY

for the Cement Industry

NORDBERG machinery for cement plant operation *assures continuous output* at *low production cost* with *dependable performance*. This machinery was developed to meet requirements of the cement industry and is backed by a long record of successful achievements in the heavy machinery field.

CRUSHING

Gyratory and Symons Cone Crushers are built by Nordberg for the entire range of primary and secondary crushing. The many Symons Cone Crushers installed in cement mills for raw feed preparation and clinker crushing prove that this crusher produces greater capacity of uniformly fine mill feed, increasing overall production with minimum power input and reduced mill maintenance expense.

GRINDING

Nordberg Grinding Mills are of rugged design and construction for long life and economical service. They are built in a wide range of types and sizes for both wet and dry grinding.

CALCINING—COOLING

Nordberg Rotary Kilns and Coolers are constructed of all welded shells with solid forged steel tires. The improved automatic lubrication system with water cooled bearings assures uninterrupted service.

SIZING—FEEDING

Symons Vibrating Bar Grizzlies and Symons Vibrating Screens are high capacity efficient operating units ideally suited for cement plant operation.

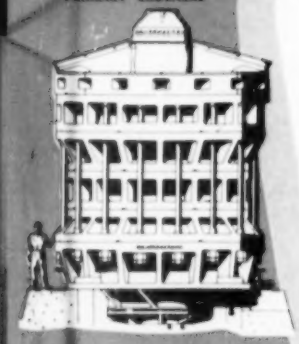
POWER GENERATION

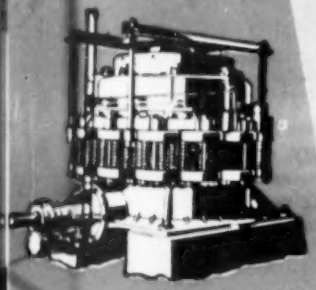
In the complete line of Nordberg two and four-cycle oil burning and Duafuel Diesels and in Nordberg gas burning engines, you will find the right size and type of unit to meet your power requirements in a range of sizes from 10 to 9600 H.P.

When contemplating a new cement plant or modernization of an existing plant, investigate the merits of Nordberg machinery designed for your industry.

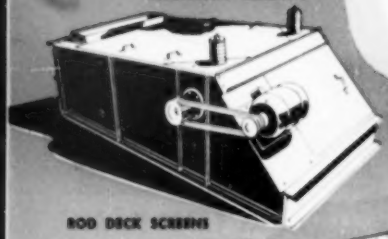
Q503

PRIMARY CRUSHERS

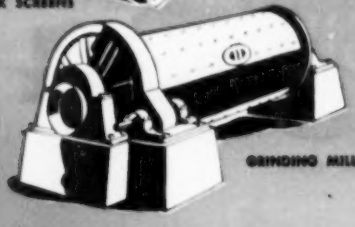




SECONDARY CRUSHERS

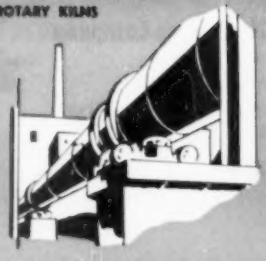


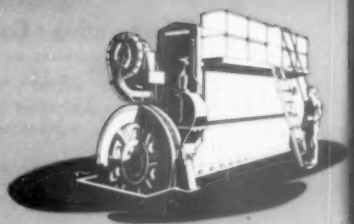
ROD DECK SCREENS



GRINDING MILLS

ROTARY KILNS





DIESEL ENGINES

NORDBERG MFG. CO.
MILWAUKEE 7, WISCONSIN
NEW YORK • SAN FRANCISCO • WASHINGTON • SPOKANE
MEXICO, D. F. • LONDON • TORONTO • JOHANNESBURG

NORDBERG MACHINERY

Let EXPERIENCE *Answer!*

Since 1926, this Bucyrus 120-B shovel has been at work in the Maple Grove plant of Basic Refractories, Inc., handling dolomite at an average annual rate of 1,000,000 tons — year in, year out.

This is the kind of excavator dependability that builds profits through years of successful operation in the toughest kinds of jobs . . . the dependability characteristic of Bucyrus-Erie quarry and mine machines today as in the past . . . the "years ahead" design, high grade materials and skilled craftsmanship that have always made Bucyrus-Eries first choice wherever sustained high production is a "must".

Let experience be your guide in choosing your excavator — the experience of satisfied owners, and the experience of Bucyrus-Erie, oldest and largest manufacturer of excavating equipment in the world.

58148

BUCYRUS ERIE

SOUTH MILWAUKEE, WISCONSIN

Norblo

Dust Collection

Always, Everywhere, Star Performance

For the cement industry the combination of Norblo Cement Air Cooling with Automatic Bag Type Dust Collection, is a new type star performance. In some rock products industries heavy duty star performance includes Norblo Hydraulic and Norblo Centrifugal Collector combinations. In zinc, lead, cadmium and other smelting and mining fields Norblo Automatic Bag Type Collectors are making outstanding records for high recovery with low operating and maintenance costs, in some of the largest installations ever built in the hemisphere.

Profit by Norblo 30 years' experience in heavy duty dust collection and Norblo development of these basic types of equipment. Write for bulletin — or tell us your problem.

THE NORTHERN BLOWER COMPANY

6408 BARBERTON AVENUE • CLEVELAND 2, OHIO

Automatic and Standard Bag Type Fume and Dust Collectors • Norblo Centrifugal and Hydraulic Collectors • Cement Air Cooling Systems • Exhaust Fans

The Story of Huron Portland Cement — Another

ALLIS-CHALMERS

Equipped Cement Plant

Keep Your Eye on Huron — to See How Record Cement Tonnage is Produced..

HURON PORTLAND CEMENT Company's multi-million dollar Alpena, Michigan, plant now produces a record 6,200,000 bbls of cement annually. This represents an increase of 50 percent over the original installation . . . an expansion program made to meet increased cement demands for housing, industrial expansion and concrete highways.

In Huron's stepped-up cement production, Allis-Chalmers has supplied much equipment: rotary kilns, crushers, dryers, grinding mills, other basic and auxiliary equipment. The result is a modern, flexible plant layout, with synchronized, automatic operation in all phases of production.

Check the operational steps here at Huron Portland Cement Co. — shown in pictures on these pages — or in the many modern cement plants throughout this country and the world. Chances are, you'll find Allis-Chalmers equipment as an integral part of sound plant design. And sound design means highest net profits for you.

Your nearby Allis-Chalmers area representative can show you how A-C cement plant equipment — and engineering — can help you get low costs and efficient production.

ALLIS-CHALMERS, 975A SO. 70 ST.
MILWAUKEE, WIS.

Boats deliver [illegible] to Huron Portland Cement [illegible] shipping points on the Great Lakes.

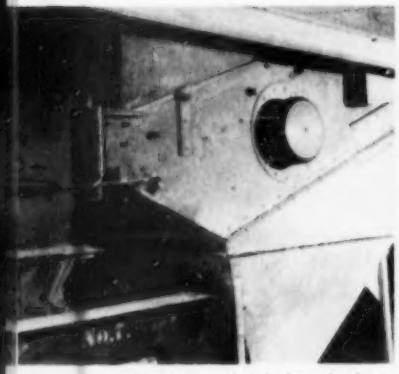
ALLIS-CHALMERS

HOW ALLIS-CHALMERS FITS INTO CEMENT MAKING

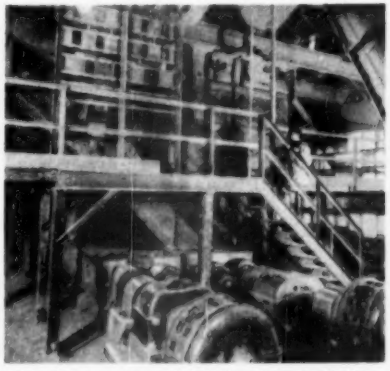
Here's another example of the broad range of Allis-Chalmers equipment for cement — installed in world's largest cement plant. A-C can design a complete cement plant — and furnish all equipment, too!

1 Huge quantities of limestone are required for Huron's annual 6,200,000 bbls of cement. Quarry-run limestone — 20 tons at a time — are dumped into 60 x 84-in. Fairmount crusher, one of two installed side by side in quarry near cement plant.

2 Each Fairmount crusher can munch up 20 tons of limestone in 32 seconds. Crushed product is hoisted to scalping screens. All minus 4-in. stone is conveyed to dryer building on conveyor.

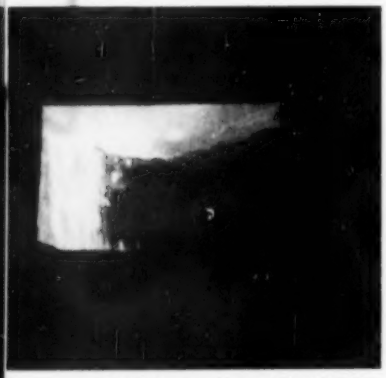


6 Limestone and shale from the dryers is screened on 4 x 8 ft Ripl-Flo vibrating screens. Hammer mills beneath screens reduce 4 to $1\frac{1}{2}$-in. feed to minus $\frac{1}{4}$-in. Screens handle 100 to 110 T.P.H.

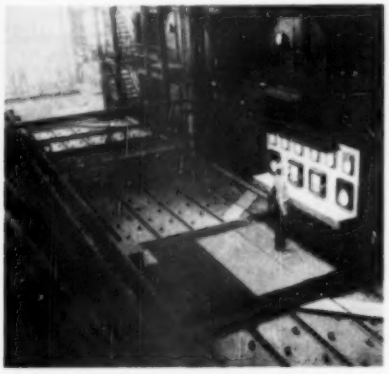


7 So far, limestone and shale have been handled separately. They meet at proportioning scales, which weigh out one part shale to four parts limestone into a balanced "raw mix." Screw conveyors beneath scales are driven by Allis-Chalmers motors.

8 Nine raw grinding Compeb mills, 7 x 26-ft, grind the stone and shale combination into suitable feed for rotary kilns. A division head separates these A-C mills into two compartments.



12 White hot cement clinker falls from kiln over Allis-Chalmers air-cooled kiln end (segmental alloy steel sections below refractory brick) which prevents kiln warpage and nose brick troubles.

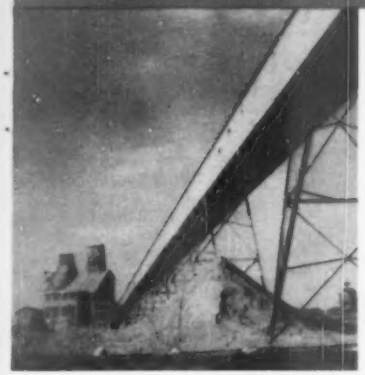


13 Waste heat boilers, one for each rotary kiln, utilize reclaimable heat from kiln exhaust gases to generate steam. 7,505,500 lbs of steam are generated every 24 hours at Huron . . . producing power enough to drive all machinery in the plant.

14 Kiln-run cement clinker is crushed in battery of four 636 Hydrocone crushers. Each of these Allis-Chalmers machines reduce 324 bbls per hour from minus $1\frac{1}{2}$ to 2-in. feed to a minus 1-in.

PRODUCER OF THE WORLD'S WIDEST RANGE OF CRUSHING,

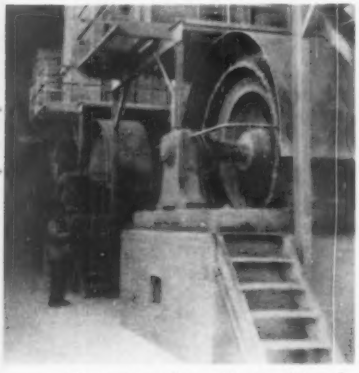
AT HURON PORTLAND CEMENT COMPANY



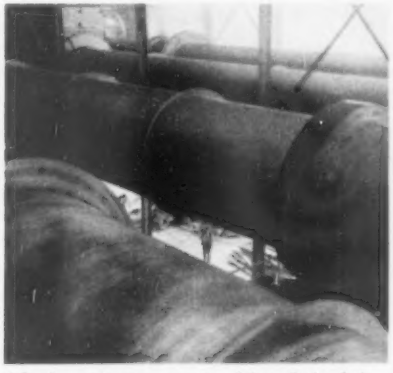
3 Conveyor housing contains four endless belts 1200 ft long, driven by Allis-Chalmers motors. Shale, another major ingredient of portland cement, comes from another quarry in hopper cars.

4 Shale drops from bottom of hopper cars to chain grizzly in dryer building. It is then fed to a 24 x 60-in. Allis-Chalmers single roll crusher which reduces it to a minus 6-in. product before going to rotary dryers for moisture removal.

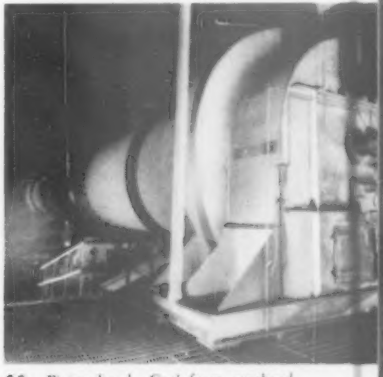
5 One of four A-C rotary dryers in dryer plant dries stone and shale by tumbling material through stream of hot gases. Four 7 x 100 ft dryers handle limestone. Two 8 x 100 ft units dry shale.



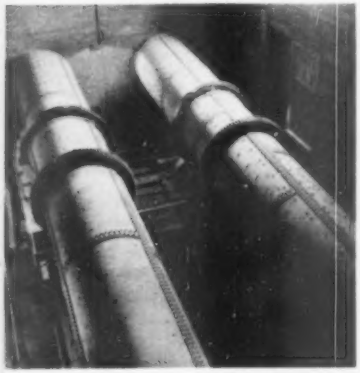
9 Raw grinding mills are driven by Allis-Chalmers 500 hp synchronous motors. Smaller Allis-Chalmers motors drive screw conveyors for feeding raw mix to Compeb mills.



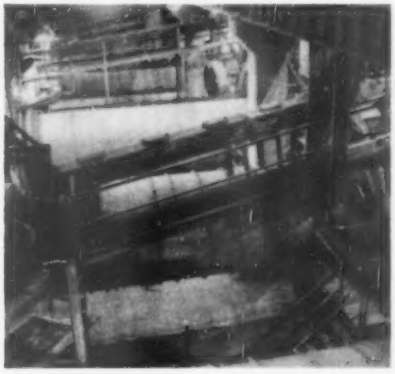
10 Raw mix goes to rotary kilns. Each of these 10 x 153½-ft Allis-Chalmers kilns produce 55 bbls of cement clinker per hour. Temperatures in kiln reach 2700° F. in clinkering zone, 15 to 20 ft from discharge end. There are 18 kilns at Huron.



11 Firing hood. Coal from overhead bin is pulverized in bowl mill, then blown into kiln. Auxiliary waste heat stack alongside firing hood conveys hot gases to dry coal before it enters kiln.



15 Gypsum is dried in these A-C 5 x 50-ft rotary dryers, then crushed. About 30 lbs of gypsum are added to each 1000 lbs of clinker to keep cement from setting too rapidly.



16 Finish grinding. Twelve 7 x 24-ft two-compartment Compeb mills grind clinker to a powder so fine it will pass through a sieve capable of holding water. Each mill operates in closed circuit. Product is 1950 surface area; 90% passes a 200-mesh screen.

17 Finish grinding is the third clinker reduction. After crushing and preliminary grinding, each of these twelve mills turns out 80 bbls of finished cement per hour.

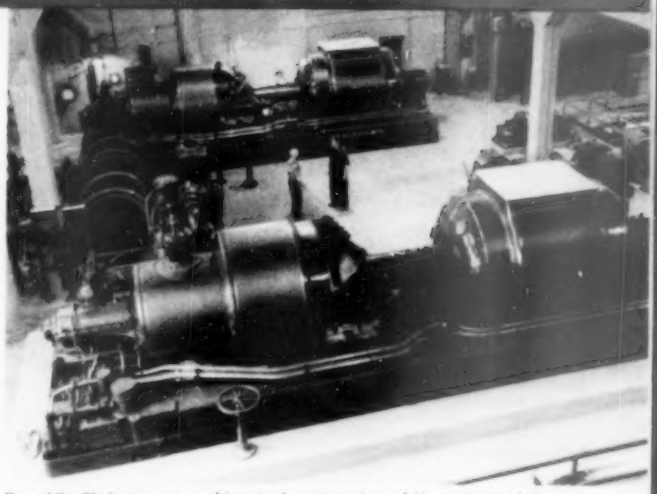
MINING AND CEMENT EQUIPMENT **ALLIS-CHALMERS**

"One Company" Responsibility is Big Advantage

IN PLANNING AHEAD for big volume production, Huron Portland Cement Co. considered it practical to specify Allis-Chalmers for a great number of their equipment needs.

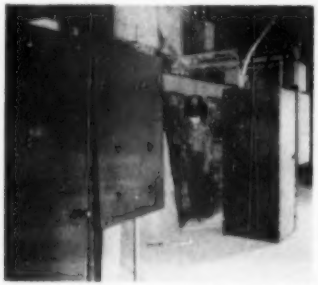
Past experience had proved the value of Allis-Chalmers equipment in terms of performance . . . and in terms of durability that results in real savings in downtime and maintenance.

Allis-Chalmers equipment can be obtained complete with motors, drives, control, all built by one company, with mechanical and electrical factors matched for best working efficiency. And — A-C maintains a large staff of field engineers trained, not only in equipment engineering, but in prompt cooperation in seeing to it that equipment keeps operating at rated performance.



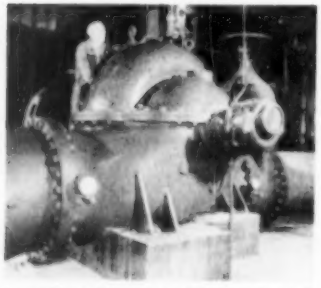
Four Allis-Chalmers steam turbines in the power plant of Huron Portland Cement Co. are typical of the reliability of Allis-Chalmers turbines. The two 3500 kw units shown above were installed in 1921 and 1924. Two others, 4,000 kw and 10,000 kw turbines, have been in operation since 1915 and 1930, respectively.

Battery of Allis-Chalmers distribution transformers, 1000 kva each, step down voltages from 4160 to 440 volts for plant use. 400,000 kw are handled daily.

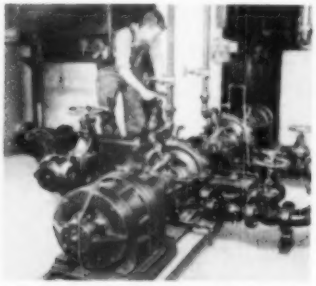


Allis-Chalmers motor control for rotary kiln provides electrical synchronization for kiln feed, cooler fan, feeder, bowl mill, dust screw, kiln tank feeder, etc.

Steam from turbine is condensed in this 96-in. two-pass Allis-Chalmers surface condenser. Condensate goes to water softening plant, then to waste heat boilers.



Large Type "S" pump, 20,000 gpm, 10 ft head, draws water from Lake Huron to a large turbine well, where it is drawn for plant use.



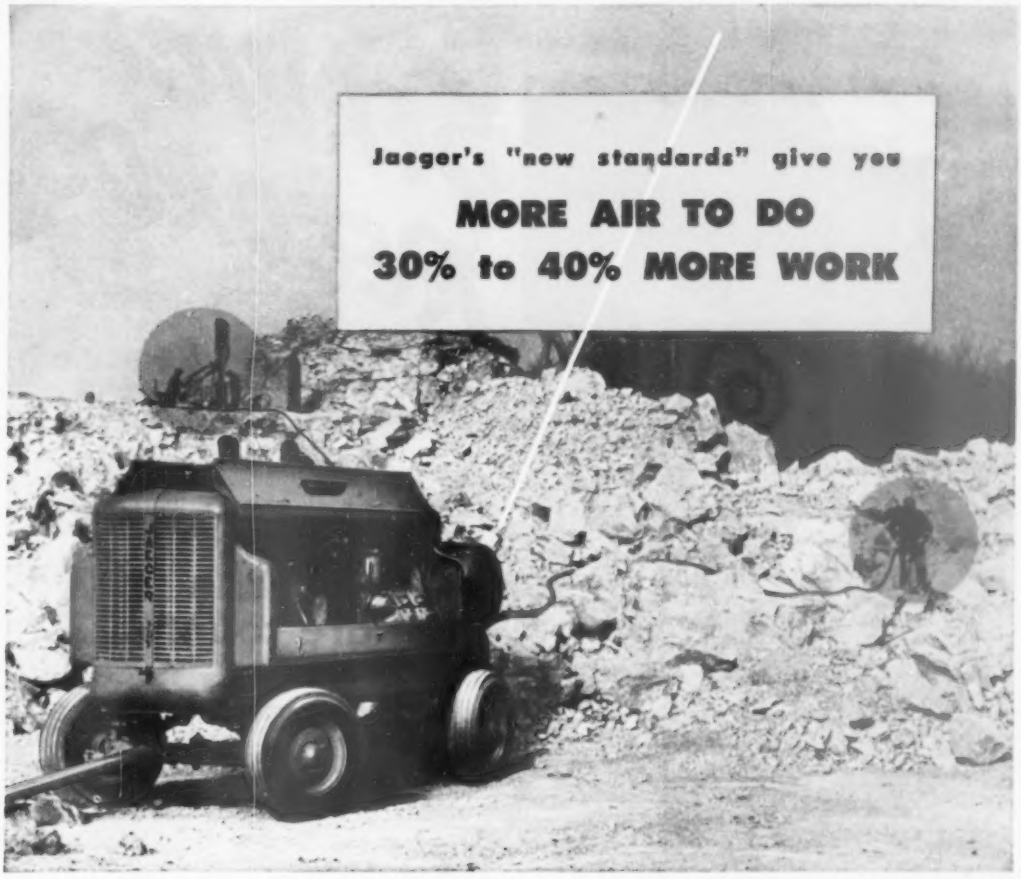
Two 6 x 5, 325 gpm, 100 ft head Allis-Chalmers condensate pumps handle condensate water from condenser. Each is driven by 15 hp Allis-Chalmers induction motor.

ALLIS-CHALMERS

MILWAUKEE 1, WISCONSIN

A-C ALLIS-CHALMERS

Pioneers in Electrical Power Equipment—Biggest of all in Range of Industrial Products



Example: "New standard" 365 ft. compressor will operate a heavy duty wagon drill plus a rock drill or heavy breaker at full 90 lbs. pressure — doing up to 40% more work than a 315 ft. unit which runs the same tools at a pressure of only 70 lbs.

Because "old standard" compressor ratings, established in 1932, do not match today's air tools and cannot operate these tools efficiently, Jaeger takes the lead in offering complete "new standard" sizes — 75 ft. of air instead of 60 — 125 ft. instead of 105 — 185 ft. instead of 160 — 250 ft. instead of 210 — 365 ft. instead of 315 — 600 ft. instead of 500.

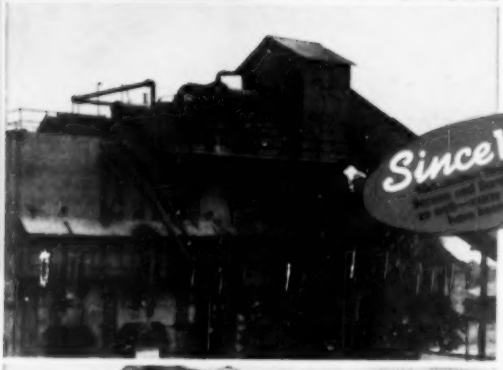
This increased air maintains the steady 90 lbs. pressure at which tools reach their full drilling speed and hitting power, actually do 30% to 40% more work than the same tools under 70 lbs. pressure from undersized compressors.

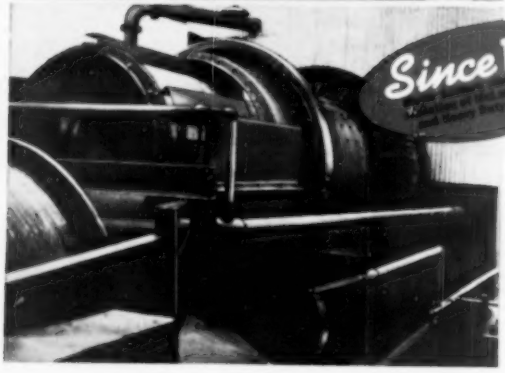
Because Jaeger's "Fuel Miser" control automatically regulates engine speed to air demand, these units do not consume an ounce more fuel than the smaller "old standard" sizes when their *additional* capacity is not being used. For full details, see your Jaeger distributor or send for new Catalog JC-8.

THE JAEGER MACHINE CO., Columbus 16, Ohio

Leading distributors in 120 cities of the United States and Canada sell, rent and service Jaeger-engineered equipment

JAEGER
engineered equipment
COMPRESSORS • DIAGONAL SCREED FINISHERS
SCREW SPREADERS • BITUMINOUS PAVERS





SERVICE RECORDS *for* McLanahan Equipment

are counted in DECADES instead of years

Plus hundreds of other service records . . . just as interesting

Long service records and amazingly low maintenance costs go hand-in-hand with McLanahan equipment. With the experience of more than a hundred years and an engineering organization which has pioneered many of the modern innovations of the industry—McLANAHAN is your logical headquarters for equipment. Write for specific information on any above or below surface modernization equipment.

Headquarters for Pit, Mine and Quarry Modernization

McLANAHAN and STONE *Corporation* Since 1835

HOLLIDAYSBURG, PA.

Look to P&H for Added Values

NOW, *it costs* LESS *to do your jobs* BETTER!

In every one of these operations, materials are being moved and handled for less—thanks to the continuous, cost-cutting performance of the P&H.

Of the many P&H Added Values, these alone will account for important savings for you. Add all the others and you know why so many operators, mindful of today's changing conditions, are putting P&H Excavators in their pits and yards.

HYDRAULIC CONTROL — years-ahead engineering makes P&H's faster and simpler to operate with a velvety action that's easier on man and machine.

PLANETARY CHAIN CROWD — P&H pioneered it; made it more accurate, more rapid reversing. Outlasts 25 to 30 crowd cables.

TRUE TRACTOR TYPE CRAWLERS—smoother, more maneuverable and dependable travel; easier steering; ends usual crawler troubles.

WELDED CONSTRUCTION THROUGHOUT — rolled alloy steels make them huskier, shockproof; no needless deadweight.

P&H DUAL-POWERED TRUCK CRANES. One engine right for faster travel, another with power right for faster working. Converts for all classes of work. Available with P&H Remote Control.

P&H CRAWLER EXCAVATORS. Built in all sizes up to 6 cu. yds.; gasoline, Diesel or electric powered. Write for literature.

Get the full story on P&H Added Values. Mail coupon on your business letterhead now!

P&H EXCAVATORS
4465 W. National Ave.
Milwaukee 14, Wis.
HARNISCHFEGER CORPORATION
EXCAVATORS · ELECTRIC CRANES · ARC WELDERS · P&H · HOISTS · WELDING ELECTRODES · MOTORS

HARNISCHFEGER CORPORATION, *Excavator Division*
4465 W. National Ave., Milwaukee 14, Wisconsin

Gentlemen:

Send complete information covering P&H models from _____ to _____ cubic yards
( ) Also P&H Truck Cranes. I am attaching coupon to my business letterhead.

Name .....

Company ..... Position .....

Address .....

City ..... Zone ..... State .....

MARINE MIRAGE!

Mirrors never made a Marine, sonny. It takes lots and lots of training, skill, and experience to make a good Marine . . . to make a good product . . . to make a good bag. Chase brings the experience of more than one hundred years to focus on packaging problems. Result: you get appearance and protection—you get a container that is designed to your specific needs! Check with Chase on this important subject today.

SINCE 1847

Bags for all industry and agriculture

- cotton bags of all kinds
- burlap bags
- paper & Multiwall bags
- open mesh bags
- combination bags, liners, and specialties.

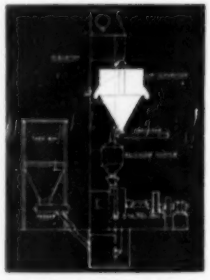
CHASE BAG CO.

GENERAL SALES OFFICES, 309 WEST JACKSON BLVD., CHICAGO 6, ILL.

BOISE • DALLAS • TOLEDO • DENVER • DETROIT • MEMPHIS • BUFFALO • ST. LOUIS • NEW YORK • CLEVELAND • MILWAUKEE
PITTSBURGH • KANSAS CITY • LOS ANGELES • MINNEAPOLIS • GOSHEN, IND. • PHILADELPHIA • NEW ORLEANS • ORLANDO, FLA. • SALT LAKE CITY
OKLAHOMA CITY • PORTLAND, ORE. • REIDSVILLE, N. C. • HARLINGEN, TEXAS • CHAGRIN FALLS, O. • HUTCHINSON, KAN. • CROSSETT, ARK. • SAN FRANCISCO

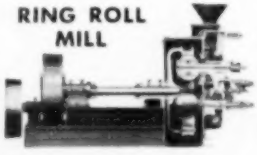
STURTEVANT AIR SEPARATORS

Produce Aggregates that meet Government Specifications



Sturtevant Air Separator in "closed circuit" with pulverizer. This combination increases tonnage and reduces costs in all types of industry.

RING ROLL MILL



Range 10 to 200 mesh. Use this mill in closed circuit with Sturtevant Air Separators.

On dam projects throughout the country, Sturtevant Air Separators are helping contractors meet U. S. Corps of Engineers specifications for proper analysis of aggregates. Here's how — Sturtevant Air Separators de-dust and remove the fine fraction according to the mesh required. Dry or damp sand can be handled in any tonnage desired in ranges from 30 mesh and finer to eliminate screen in the production of intermediate sizes.

The de-dusted sand of proper mesh is then inter-blended with the screened sand or aggregates in the proper proportions providing aggregates that meet specifications.

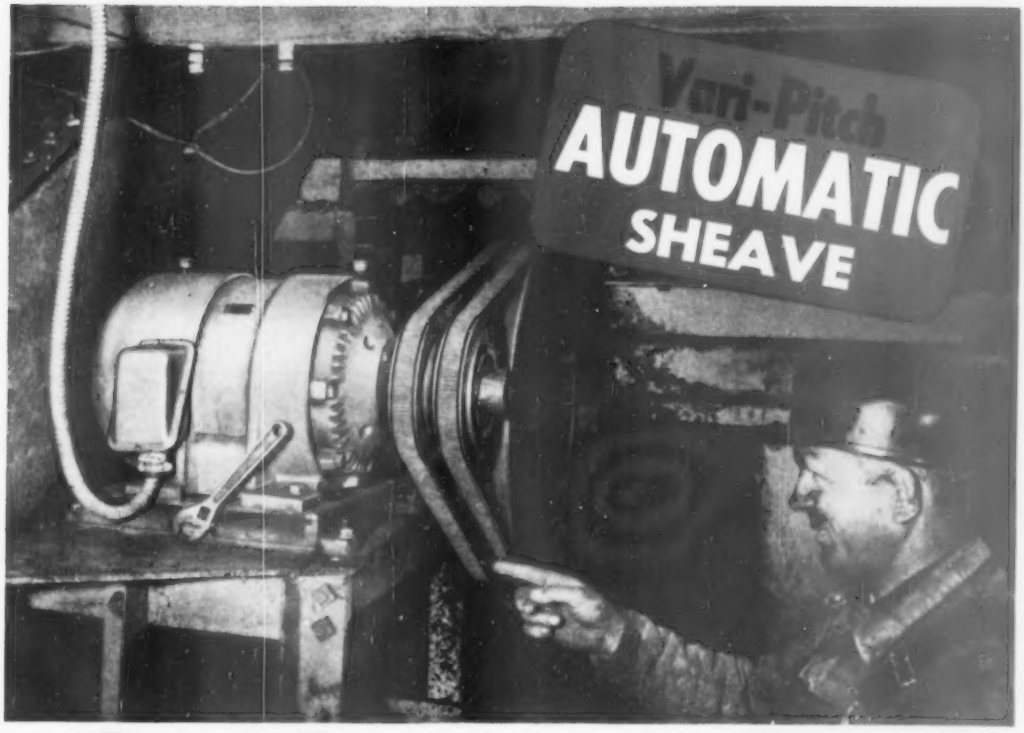
Sturtevant Air Separators are fast and accurate. They increase production of aggregates, cut production costs.

Investigate Sturtevant Air Separators for your jobs. Write for details, today.

STURTEVANT MILL COMPANY

102 CLAYTON STREET, BOSTON 24, MASSACHUSETTS

Designers and Manufacturers of: CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS MECHANICAL DENS and EXCAVATORS • ELEVATORS • MIXERS



Best Buy in Variable Speed!

COMPARE THESE FEATURES of *Vari-Pitch* Automatic sheave with any other variable speed drive and see why *Vari-Pitch* Automatic drive gives you more for your drive dollar.

1. Changes speeds with one hand while machine is running.
2. All mechanism is inside one sheave actuated by movement of the motor base.
3. Ample capacity and safety factor of multiple belts.
4. Full range of sizes from 1 to 40 hp.
5. Top speed is 100% higher than low speed.
6. Quiet operation.
7. Cushioned start.
8. Simple design and easy installation make cost low.
9. Occupies no more space than ordinary sheave.

Vari-Pitch Automatic drive will pay for itself very quickly in increased production, improved quality and more flexible operation on many machines in your plant. Ask your Allis-Chalmers Authorized Dealer or Sales Office representative to give you savings and cost figures on your operations. Or write for bulletin 20B7223.

ALLIS-CHALMERS, 975A SO. 70 ST.
MILWAUKEE, WIS.

Vari-Pitch and *Texrope* are Allis-Chalmers trademarks. A-3064

Sold . . .
Applied . . .
Serviced . . .

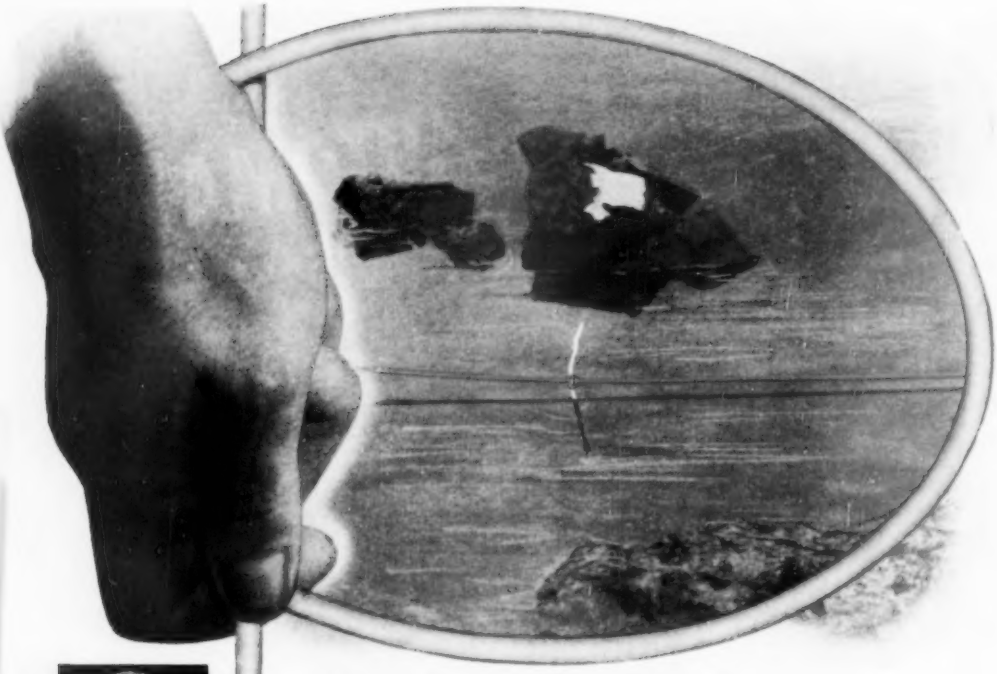
by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

MOTORS — ½ to 25,000 hp and up. All types.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

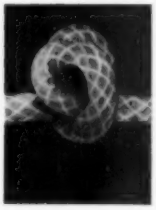
PUMPS — Integral motor and coupled types from ¾ in. to 72 in. discharge and up.

ALLIS-CHALMERS



Plastic Reinforced Primacord is recommended for all "down" lines. Use Plain Primacord for surface or "ground" lines. To make the most effective hook-up, use a simple clove hitch in the *ground* line, as shown in these three photographs.

Tough going calls for



The twin loops have been folded over to form a hole.

PLASTIC REINFORCED PRIMACORD®

Surface water, sludge and mud need not delay your loading operations if you use the new Plastic Reinforced Primacord for the "down" lines. The seamless plastic cover is *waterproof* and resists penetration even at high pressures. It is also smooth, tough and resistant to the action of the acids commonly encountered. Sub-zero cold and high summer heat do not affect Plastic Reinforced Primacord. Its weight is about the same as Plain Primacord and its tensile strength is greater than that of Wire Countered Primacord.

Use Plastic Reinforced Primacord in deep, wet holes, in preloading, pipe line river crossing, horizontal holes, marine work, coyote tunnels and sleeper shots for seismograph work.

Pass the Plastic Reinforced Primacord through this hole and draw the two ends up *tight*.

THE ENSIGN-BICKFORD COMPANY • SIMSBURY, CONN.

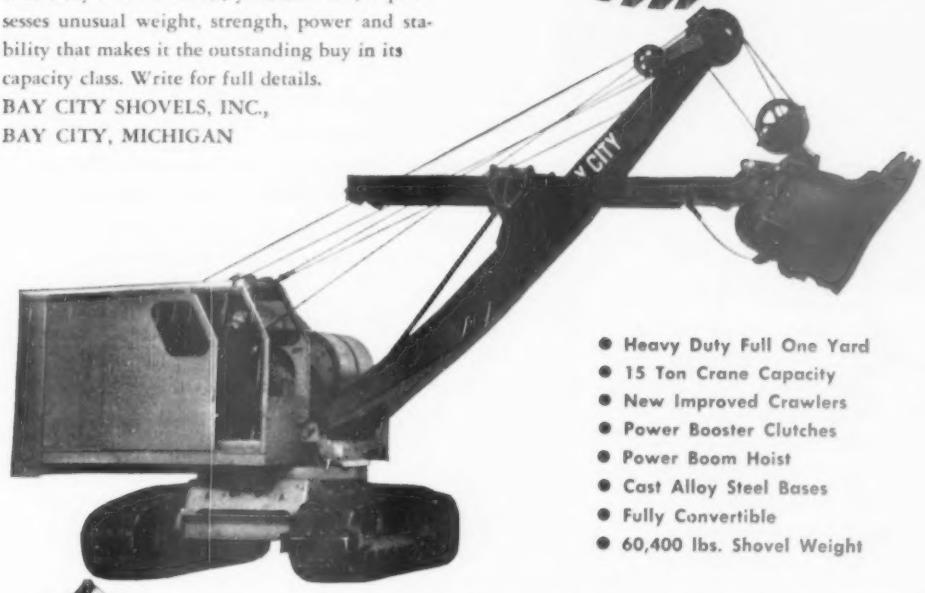
PRIMACORD- BICKFORD DETONATING FUSE • SAFETY FUSE SINCE 1836

MORE POWER— MORE WEIGHT—MORE STABILITY IN THIS 1 YARD CONVERTIBLE SHOVEL...

the new

BAY CITY MODEL 59

Because the new Bay City Model 59 one yard shovel is actually a modified 1¼ yard machine, it possesses unusual weight, strength, power and stability that makes it the outstanding buy in its capacity class. Write for full details.
BAY CITY SHOVELS, INC.,
BAY CITY, MICHIGAN



- Heavy Duty Full One Yard
- 15 Ton Crane Capacity
- New Improved Crawlers
- Power Booster Clutches
- Power Boom Hoist
- Cast Alloy Steel Bases
- Fully Convertible
- 60,400 lbs. Shovel Weight

BAY CITY

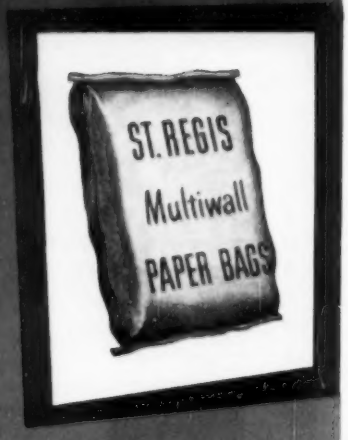
SHOVELS • CRANES • HOES • DRAGLINES • CLAMSHELLS

ask the men

WHO BUY THEM

...and the men

WHO USE THEM!



THEY'LL TELL YOU . . . St. Regis Multiwalls are uniformly high in quality and construction . . . are dependable, efficient, help increase production and lower costs . . . are easy to handle . . . easy to use. These are "reasons why" more St. Regis Multiwalls are purchased by cement mills than any other multiwall bag!

Are you interested in getting a brighter, cleaner package for your product? Your St. Regis Representative will gladly show you how a St. Regis 150-FC Valve Bag Packer can fill up to *1300 bags of cement* an hour in *clean* St. Regis Multiwalls! Ask him, next time he calls!

SALES SUBSIDIARY OF ST. REGIS PAPER COMPANY

ST. REGIS
SALES CORPORATION
230 PARK AVENUE • NEW YORK 17, N. Y.

Allentown, Pa. Atlanta
Baltimore Birmingham
Boston Chicago
Cleveland Denver
Detroit Houston
Kansas City, Mo. Los Angeles
Louisville Minneapolis
New York Norfolk Ocala, Fla.
Portland, Ore. St. Louis
San Francisco Seattle

In Canada:
St. Regis Paper Co. (Can.) Ltd.
Montreal Hamilton Vancouver

YOU BUY PROTECTION WHEN YOU BUY MULTIWALLS

Before you buy

a diesel engine

...be sure and read this booklet!

A sound basis of comparison is essential to the selection of the proper diesel engine to meet your power requirements. And that's just what the booklet *"10 Questions to Ask a Diesel Engine Salesman"* gives you. If you want economy, dependability and long engine life this booklet will show you what to look for in a diesel engine.

In addition, the *"10 Questions"* booklet describes fully the Murphy Diesel line of heavy duty "true" diesel engines, giving design details and basic specifications. No diesel power user or prospective diesel power user should be without this helpful 28-page booklet. Write for your copy, mentioning your company affiliation and position.

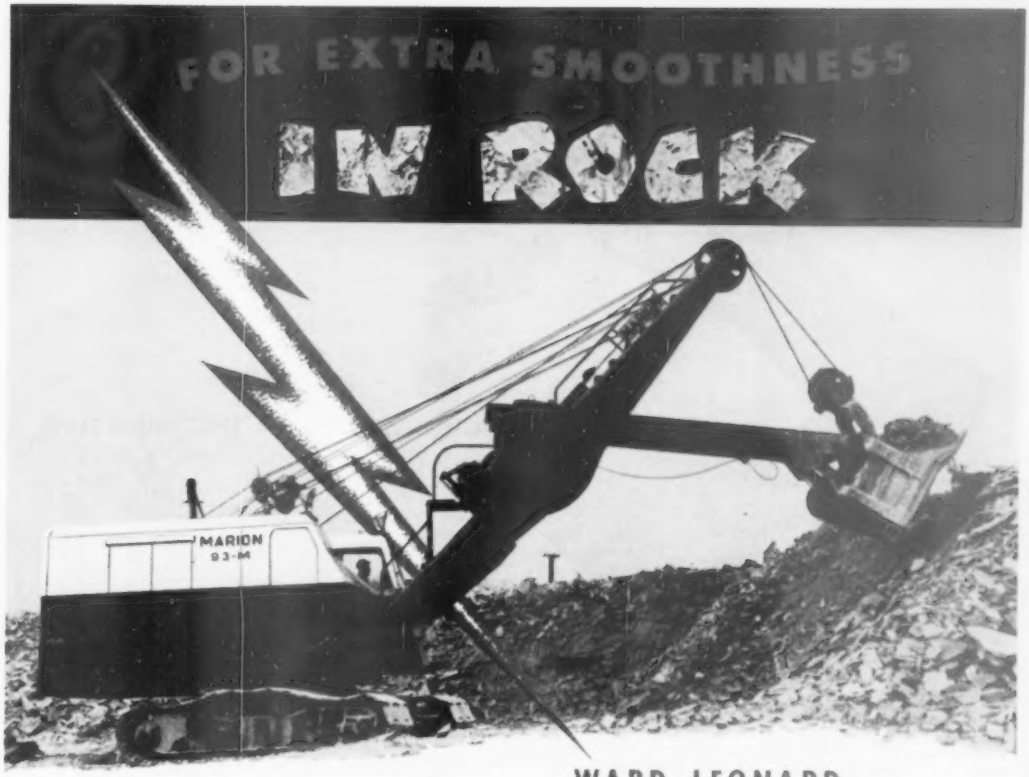
MURPHY DIESEL COMPANY

5315 W. Burnham St., Milwaukee 14, Wisconsin

DEALERS IN PRINCIPAL CENTERS
Throughout the nation

Heavy duty power
for rock crushing

Murphy Diesel Engines and Power Units for portable or stationary crushing plants, 90 to 220 H.P. Generator Sets, 60 to 133 K.W.



WARD-LEONARD

MARION 93-M ELECTRIC

The new MARION 93-M Ward-Leonard Electric shovel digs rock with smoothness you'd never expect from a 2½-3 cu. yd. machine.

There's no jerking—no hesitating—no "stuttering" when the dipper comes up through a rock pile. There is power to spare, applied so smoothly that there is no machine strain or breakage.

This is the kind of smoothness that pays off in longer machine life, greater daily yardage and greater dependability.

From its long, wide, steady crawlers to the big, reversible dipper teeth, here is a MARION designed and built for service in rock digging.

The 93-M is built to MARION standards of quality that mean year-after-year dependability and true, long-range economy. It is backed by 66 years of shovel design and manufacturing experience.

Call your nearest MARION representative, or write to the factory.

MARION POWER SHOVEL CO.
MARION, OHIO, U. S. A.
OFFICES AND WAREHOUSES IN ALL PRINCIPAL CITIES

THERMALLOY* FEED PIPE can really TAKE IT!

Thermalloy feed pipe assembly employing angled design for special installation.

Thermalloy "47" feed pipe and support pipe, 16" diameter.

Thermalloy 12' long kiln feed pipe.

Stands up under abrasion, rough usage, heavy loads, high temperatures

If you're looking for longer service life from feed pipe and other kiln parts . . . investigate Thermalloy.

In scores of kiln installations, Thermalloy feed pipes have proved their ability to withstand elevated temperatures up to 2150°F without scaling or cracking.

Thermalloy feed pipes are available in a variety of designs—depending on method of support, relative position of hopper and kiln, design of kiln and size of pipe required. Let an Electro-Alloys engineer assist you in selecting the design and alloy best suited to your needs. Call your nearest Electro-Alloys office, or write Electro-Alloys Division, 2018 Taylor Street, Elyria, Ohio. *Reg. U. S. Pat. Off.

Specify THERMALLOY* for heat and abrasion resistance . . . CHEMALLOY* for corrosion resistance

AMERICAN Brake Shoe COMPANY

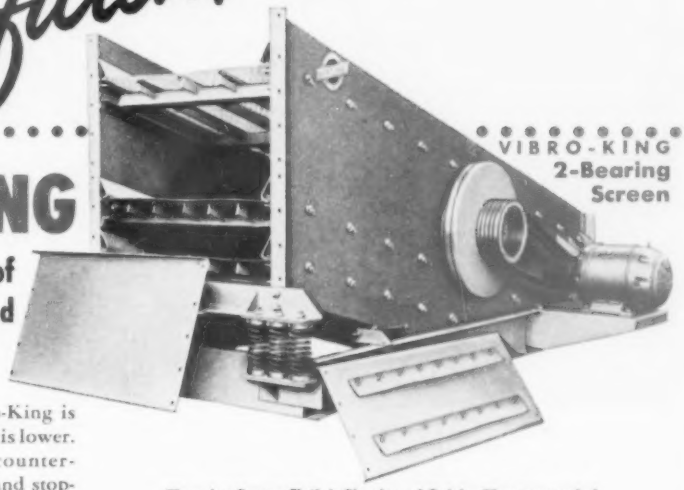
ELECTRO-ALLOYS DIVISION
ELYRIA, OHIO

TELSMITH®

more efficient screening

VIBRO-KING

For Finished Screening of Medium and Small Sized Aggregate



VIBRO-KING
2-Bearing
Screen

With its two bearings, the Vibro-King is simpler, more efficient, and upkeep is lower. Telsmith-patented automatic counterweights assure smooth starting and stopping as well as exceptionally smooth operation. Its circular screening movement is uniform everywhere on the screen cloth, and is constant under any load. Entire vibrating mechanism, including vibrating unit and screen cloth, floats on nests of springs. Welded and reinforced main frame is *horizontal* for rigidity and easy installation. Cable suspension, if desired. Five sizes, 1, 2, or 3 decks.

Changing Screen Cloth is Simple and Quick—The upper end of the Vibro-King is readily removable, making it a much easier job to change screen cloth and saving a great deal of time.

Screen Cloth Mounting—At customer's option screen cloth may be mounted in rubber on steel screen trays; or stretched over steel screen supports—protected by rubber—on any deck or decks.

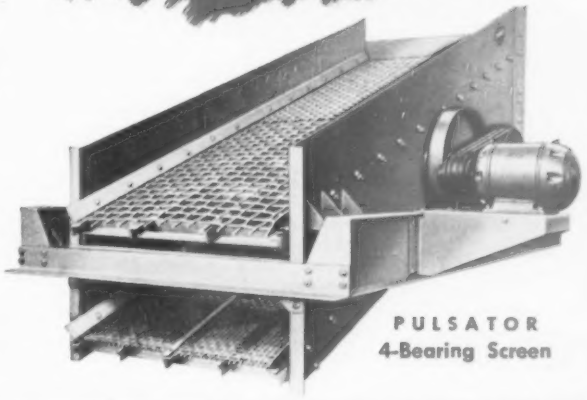
SEND FOR BULLETIN 266

PULSATOR

For Heavy-Duty Scalping

A four-bearing, heavy-duty vibrator . . . for all kinds of screening, especially scalping, or large sized aggregate . . . Pulsator's circular movement gives uniform, efficient screening on all decks and under heaviest loads. The best alloy steels, the finest antifriction bearings, protected by both labyrinth and piston ring seals, give longer life and lower upkeep. Eleven sizes, with 1, 2 or 3 decks.

V-1

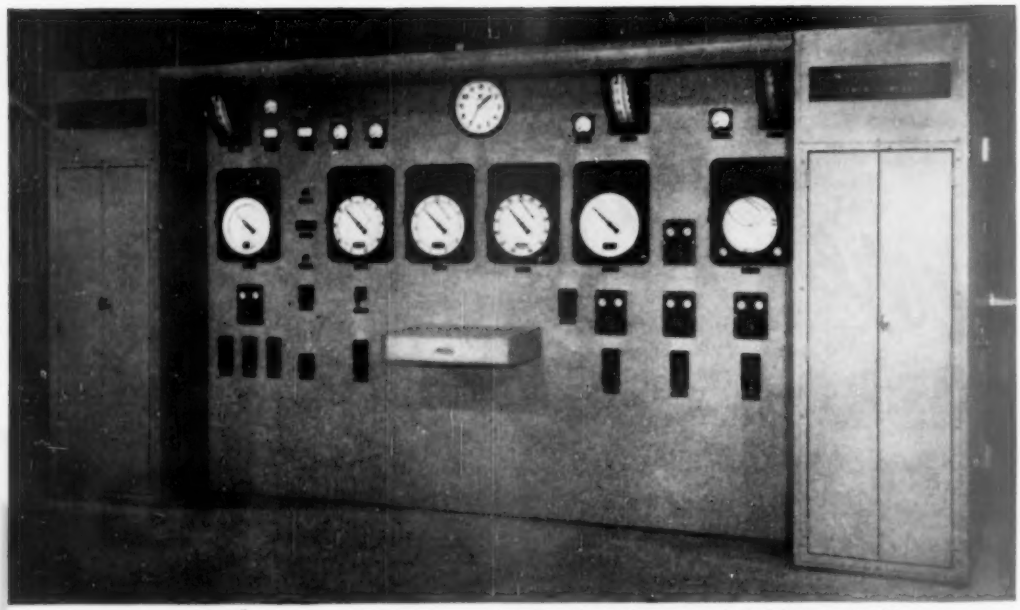


PULSATOR
4-Bearing Screen

SMITH ENGINEERING WORKS, 508 E. CAPITOL DRIVE, MILWAUKEE 12, WISCONSIN

Cable Address: Sengworks, Milwaukee

51 East 42nd St. New York 17, N. Y. — 211 W. Wacker Drive Chicago 6, Ill. — 713 Commercial Trust Bldg. Philadelphia 2, Pa. — 238 Main Street Cambridge 42, Mass. — Boehck Eqpt. Co. Milwaukee 3, Wis. — Brandeis Mach. & Supply Co., Inc. Louisville 8, Ky., & Evansville, Ind.
Clyde Equipment Co., Portland 9, Ore., & Seattle 4, Wash. • Mines Eng. & Eqpt. Co., San Francisco 4, Calif. • Interstate Equipment Co., Statesville, N. C.
• Rish Equipment Co. Charleston 22, & Clarksburg, W. Va.—Roanoke 7, & Richmond 10, Va. • Wilson-Weesner-Wilkinson Co., Knoxville 8, & Nashville 6, Tenn.



Main Panel Board for control of 3000 bbl per day Kiln at Missouri Portland Cement Company, St. Louis, Missouri.

3 Ways Better

...Bailey Control for Rotary Kilns

Bailey Control for Rotary Kilns gives you better performance three ways:

1. Economical Operation
2. Uniform Quality of Product
3. Reduced Maintenance

These are advantages which can be achieved when all phases of kiln operation are coordinated to work together as a team. Here's how Bailey Kiln Control can help you get all three.

ECONOMICAL OPERATION

With Bailey Combustion Control you can be certain that you are getting maximum product for every unit of fuel you burn. Bailey Control closely guards the Fuel-Air Ratio, Hood Draft, Fuel Feed, Clinker Cooling and the Temperature of Air for Combustion.

UNIFORM QUALITY OF PRODUCT

Bailey Instruments and Controls can help you achieve a uniform high grade product. Measurements of temperatures, kiln speed, combustibles content, and oxygen content can be transmitted to recorders on centrally located control boards like the one shown. There is no sacrifice of accuracy or speed of response. High temperature alarm contacts may also be provided with Bailey Pyrometers as a further aid in achieving optimum uniformity of product.

REDUCED MAINTENANCE

By maintaining uniform temperatures and excess air conditions in the kiln, Bailey Controls help to reduce to a minimum costly refractory repairs and wear and tear on auxiliary equipment.

Bailey Meter Company has a staff of engineers who are experts in the control of rotary kilns. Assure yourself of optimum kiln performance. Let one of these men help plan your Kiln Control System.

P-22

BAILEY METER COMPANY

1039 IVANHOE ROAD • • • CLEVELAND 10, OHIO

Controls for Processing

TEMPERATURE FLOW
PRESSURE LEVEL
% OXYGEN DENSITY
% COMBUSTION RATIO

Barber-Greene

NEW BOOK PRESENTS THE Redi-Fab SERIES

a new, practical, simplified conception of belt conveyors

Send for Your Copy

Here in this new 40-page catalog Barber-Greene presents the Redi-Fab series of belt conveyors—in a manner that completely simplifies the operation of conveyor selection and application.

An entirely new concept of belt conveyor design, the Redi-Fab series enables you to get a belt conveyor equipment almost instantly—and delivery from stock.

And this new 40-page Redi-Fab catalog makes it possible for you to figure your own requirements if you wish. No knowledge of horsepower required. Your Redi-Fab Conveyor, which you can select from this catalog, will automatically have the correct size of drive and motor. In fact, with the new layout sheet in the Redi-Fab catalog you can make your own layout, right down to locating and selecting the "A" frame supports. These are just the high spots—fill in the coupon and get your copy at once.

Use this coupon!

to bring your copy of this new catalog!

Barber-Greene Company
Aurora, Illinois, U.S.A.

( ) Send me my copy of the Redi-Fab Catalog.
( ) Have a representative call.

Name .....

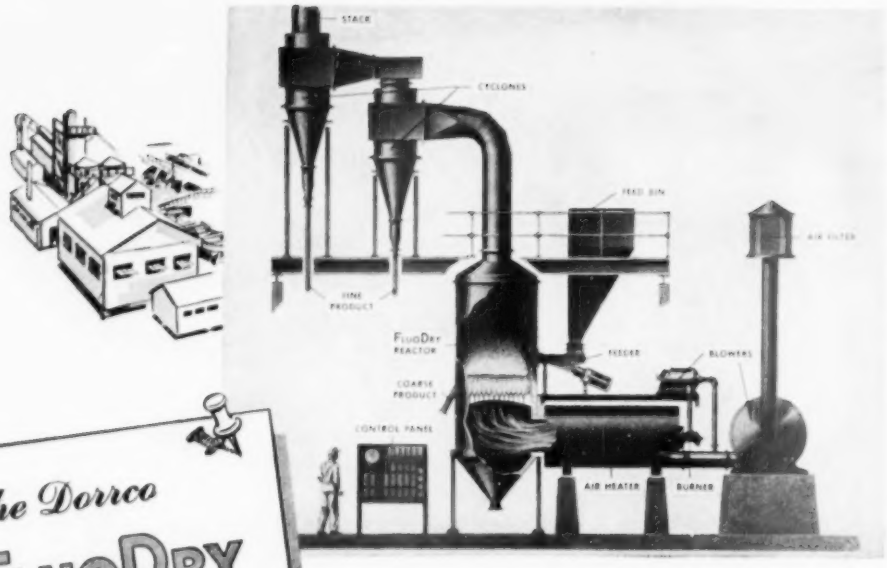
Firm Name .....

Address .....

City ..... State .....

BARBER-GREENE
AURORA, ILLINOIS

Constant Flow Equipment



the Dorrco

FLUODRY

system

A new method of drying surface moisture and of accurately dry-sizing in the 28 to 100 mesh range through the use of fluidization.

Limestone and Dolomite Fines

FluoDry can dry limestone or dolomite fines as produced, or as reclaimed from stockpile, and recover them as such salable products as limestone sands, agstone or higher-priced fillers.

Sand Products

FluoDry can dry, or selectively size, sand products in those ranges where the material is too fine to screen and too coarse for air separation.

Industrial Minerals

FluoDry can dry industrial minerals such as phosphate rock, potash and ilmenite sands with greater efficiency and economy than conventional methods.

•

If these facts sound interesting and you have an active problem of drying or sizing, we will be glad to discuss it in detail.

WHAT ARE THE ADVANTAGES OF FLUODRY AS COMPARED WITH CONVENTIONAL DRYING AND SIZING METHODS?

1. More accurate temperature control
2. Lower fuel requirements
3. Lower maintenance costs
4. Lower investment cost
5. Lower operating cost
6. No moving parts

DORRCO

THE DORR COMPANY, ENGINEERS
BARRY PLACE, STAMFORD, CONN.
NEW YORK • ATLANTA • TORONTO
CHICAGO • DENVER • LOS ANGELES
RESEARCH AND TESTING LABORATORIES
WESTPORT, CONN.
SUGAR PROCESSING
PETREE & DORR DIVISION, STAMFORD, CONN.
ASSOCIATES AND REPRESENTATIVES
Dorr Technical Services and Equipment Are Also Available Through Associated Companies and Representatives in the Principal Cities of the World. Names and Addresses on Request.

RESEARCH ENGINEERING EQUIPMENT

Loading 200 yards of shot-rock hourly

Two hundred cubic yards of shot-rock per hour — 2000 yards per day — this T7 TRAXCAVATOR is loading, directly from the blast area.

The T7's traction turns its 81 heavy-duty horsepower into sustained "crowd" — to fill its bucket without time-wasting, unproductive "tries"! This big unit's fast and positive mechanical hoist is dependable in all weather, with V-belt drive heavily armored against rock damage.

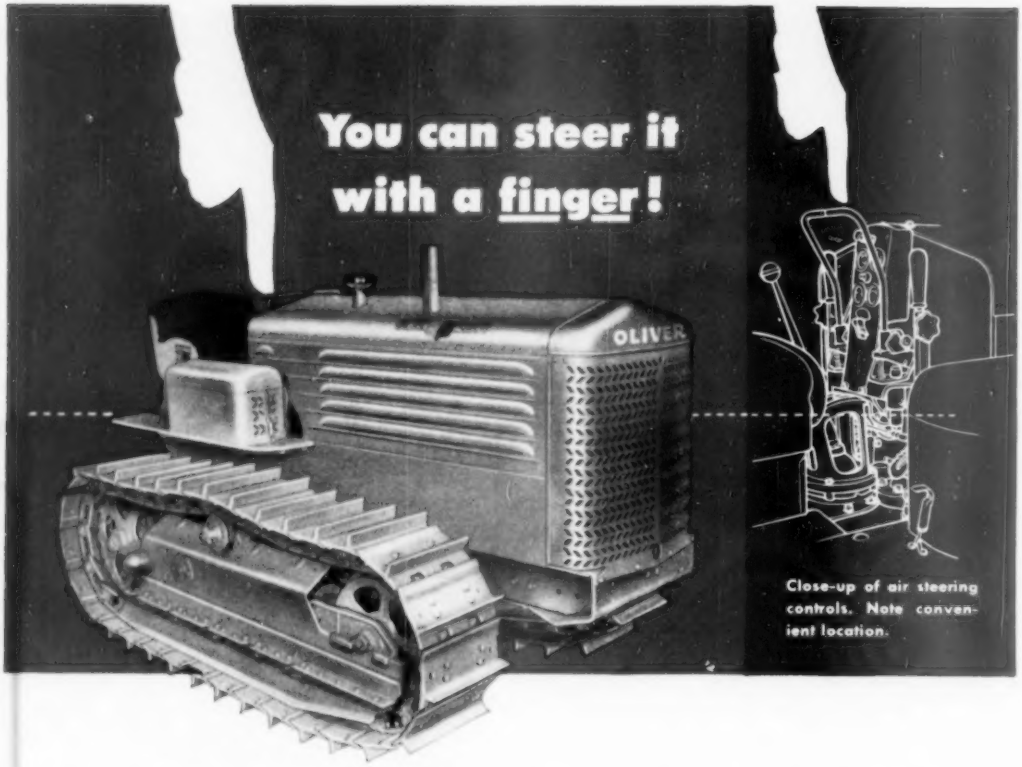
Mobile and responsive, the powerful T7 has travel speeds up to 6 miles per hour to suit any quarry loading, stock-piling or overburden stripping situation. Behind its production advantages, is unit engineering — strength and wear-resistance to match the "Caterpillar" Diesel D7 Tractor, for long life and low upkeep.

Big TRAXCAVATORS, the T6 and the T7 are unique for many-purpose usefulness and large capacity, in quarries, clay and gravel pits. One of these versatile units fulfills the money-making functions of several limited-duty machines!

The 5 Models (½ to 4 cubic yards capacity) make TRAXCAVATOR the only tractor-shovel line from which to choose the one that fits your job and purpose. For full details, see your TRACKSON-"Caterpillar" Dealer, or write TRACKSON COMPANY, Dept. PQ-70, Milwaukee 1, Wisconsin.

TRAXCAVATOR® *The Original Tractor Excavator*

You can steer it with a finger!



Close-up of air steering controls. Note convenient location.

Here's a good "steer" in tractors...the Oliver Model D Crawler and its new *air steering.** This new finger-tip steering makes life easy for the operator . . . cuts down fatigue and lets him get more done per day.

Two conveniently located steering levers can be operated at the touch of a finger . . . assure instant, positive steering control. A compressor mounted to the front of the engine block and driven by the fan belt does all the hard work.

In addition to new air steering, the Model D brings you other outstanding advantages that add up to more money in your pocket. 61.2 H.P. in the gasoline model and 61.19 H.P. in the Diesel Model; 4 forward and 2 reverse speeds; exclusive Oliver steering principle that keeps power on both tracks at all times; rugged, sound construction; easy operation and maintenance are among the many Oliver features that make the Model D the top choice among men who want value for their tractor dollar.

For complete details, see your Oliver Industrial Distributor or write The OLIVER Corporation, Industrial Division, Cleveland, Ohio.

*Available as optional equipment.

THE OLIVER CORPORATION

A complete line of industrial wheel and crawler tractors

"FINEST IN INDUSTRIAL MACHINERY"

THE OLIVER CORPORATION

NEEDS NO MUD PROTECTION . . .

GARDNER-DENVER
VP4 SUMP PUMP

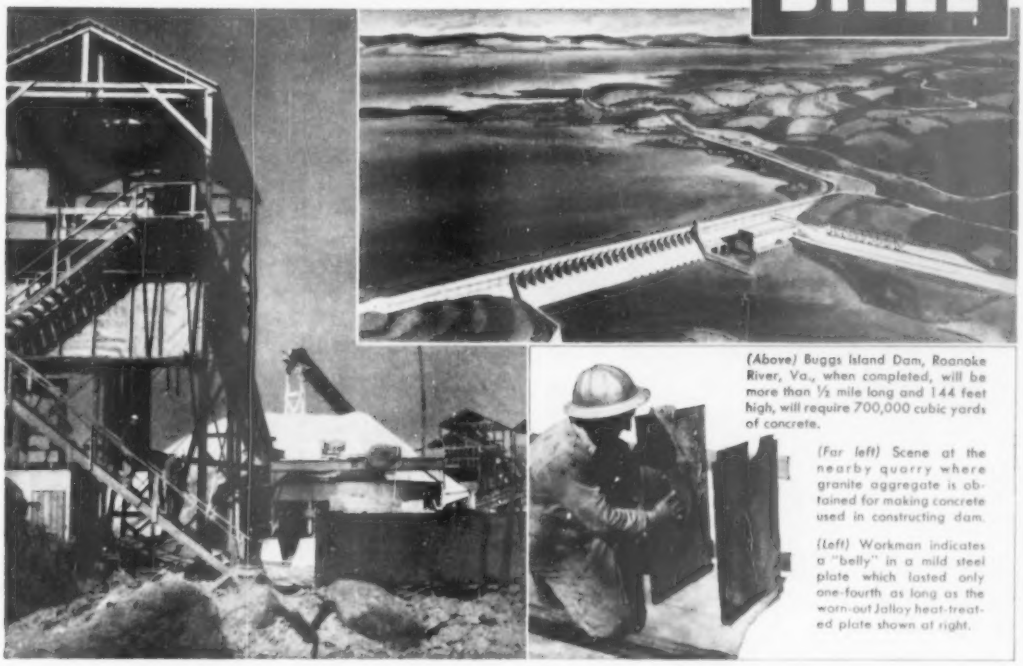
Mud can't hurt the Gardner-Denver VP4 Pneumatic Sump Pump. Designed on a new principle of TOP-SUCTION—the VP4 can't "dig in"—won't bury itself in a muddy sump—won't block inlet flow. Top-suction also eliminates one of the most common causes of pump failure—breaking of the pump shaft seal because of water pressure. *Top-suction* keeps all dirt and water away from the oil seal, bearings and air motor—actually pulls lubricant into the seal. Write for complete information about this *better* sump pump.

GARDNER-DENVER
Since 1859

Gardner-Denver Company, Quincy, Illinois
In Canada:
Gardner-Denver Company (Canada) Ltd., Toronto, Ontario

$12,500 SAVED in construction equipment maintenance with first 45 tons of Heat-treated JALLOY STEEL PLATE

J&L STEEL



(Above) Buggs Island Dam, Roanoke River, Va., when completed, will be more than ½ mile long and 144 feet high, will require 700,000 cubic yards of concrete.

(Far left) Scene at the nearby quarry where granite aggregate is obtained for making concrete used in constructing dam.

(Left) Workman indicates a "belly" in a mild steel plate which lasted only one-fourth as long as the worn-out Jalloy heat-treated plate shown at right.

JALLOY Heat-Treated Plate lasts 4 to 5 times as long as mild steel in handling crushed stone for Buggs Island Dam

Buggs Island Dam, across the Roanoke River near South Hill, Va., is being constructed by Department of the Army, Corps of Engineers, Norfolk District. Granite is blasted from a quarry three miles from the dam site and crushed into various sizes. In moving and handling this hard abrasive rock, *worthwhile* savings are being made by using heat-treated JALLOY plate for: Chutes, screening equipment, truck bodies, shovel-dipper teeth and similar materials-handling applications.

At the quarry, operated by Ralph E. Mills and Gorman Bros., Inc., direct comparisons show that heat-treated JALLOY plate lasts an average of 5 times as long as mild steel. During the first 11 months, approximately 25 tons of JALLOY heat-treated plate were installed at the quarry.

At the dam, Jones-Tompkins-Wright, Contractors, installed approximately 20 tons of heat-treated JALLOY plate during the first 10 months of operations. Here JALLOY lasts on an average of 4 times as long as mild steel.

At both locations, approximately 45 tons of JALLOY heat-treated plate have effected a saving in the cost of steel for maintenance alone of more than $10,000. Labor savings in man-hours worked by maintenance crews have been conservatively estimated at more than $2,500.

Wherever heat-treated JALLOY plate is used to resist abrasion and impact, similar results are being obtained. Little wonder that this manganese moly steel is becoming so popular in materials-handling operations. Let us send you our booklet, "For Longer Wear . . . Less Repair." It describes how others are saving money with heat-treated JALLOY Steel Plate, The Mining and Quarrying Steel.

Jones & Laughlin Steel Corporation
481 Jones & Laughlin Building
Pittsburgh 30, Pa.

Please send me a copy of: "For Longer Wear . . . Less Repair — JALLOY — J&L Special Alloy Steel."

NAME_____

COMPANY_____

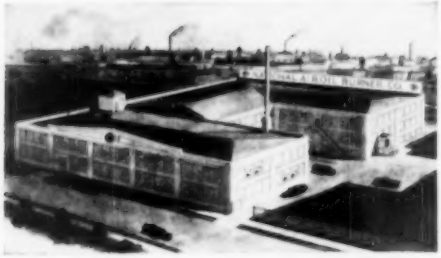
ADDRESS_____

JONES & LAUGHLIN STEEL CORPORATION

From its own raw materials, J&L manufactures a full line of carbon steel products, as well as certain products in OTISCOLOY *and* JALLOY *(hi-tensile steels).*

PRINCIPAL PRODUCTS: HOT ROLLED AND COLD FINISHED BARS AND SHAPES • STRUCTURAL SHAPES • HOT AND COLD ROLLED STRIP AND SHEETS • TUBULAR, WIRE AND TIN MILL PRODUCTS • "PRECISIONBILT" WIRE ROPE • COAL CHEMICALS

the Right Liquid Fuel Burner or Gas Burner for Your Job



The factory, salesrooms and general offices of National Airoil Burner Company, Incorporated, are housed in this modern daylight plant at "L" Street, Sedgley Avenue and Pennsylvania Railroad, in the great Northeast Industrial Section of Philadelphia.

Whether you burn tar, oil, gas or a combination of these fuels, there's a NATIONAL AIROIL BURNER for your job.

Our more than 37 years' experience in the design, development and manufacture of all types of industrial burners is at your service.

Ask us about your requirements . . . we'll gladly give you full information.

TYPE "SA"

(For use where steam is available) *atomizes thoroughly* and *burns completely*, the lowest and cheapest grades of fuel oil and tar, requiring only low oil pressure and temperatures.

Send for Bulletin No. 21.

TYPE "S-A-L"

(Large capacity burner similar to TYPE "S-A-R") is adaptable in combination with powdered coal burners in large boilers.

Send for Bulletin No. 24.

TYPE "S-A-R"

(Where steam, or gas is available for atomizing) safely and efficiently burns residuums obtained from process.

Send for Bulletin No. 23.

COMBINATION GAS AND OIL BURNER

—the "AIROCOOL" Gas Burner in combination with a TYPE "S-A-R" Oil Burner. Send for "Airocool" Brochure.

"AIROCOOL" GAS BURNER

(Of venturi type), assures low turndown without burnback. Send for "Airocool" Brochure.

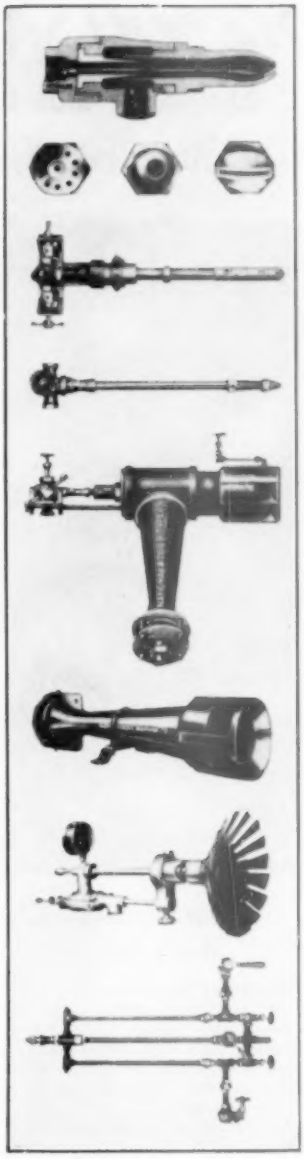
MECHANICAL PRESSURE ATOMIZING OIL BURNERS

with multi-vane type air diffuser to give a positive swirl to entering combustion air. Send for Bulletin No. 13.

TYPE "S-A-D"

(Refuse Oil Burner) burns acids or caustic sludges, asphalts, tank bottoms, polymer oils, heavy petrolatum, organic oil residuums, waste cutting oils, sulphite pulp liquors, tars, pitches, etc. in combination with fuel oil.

Send for Bulletin No. 21.



OIL BURNERS and GAS BURNERS for industrial power, process and heating purposes; STEAM ATOMIZING OIL BURNERS; MOTOR-DRIVEN ROTARY OIL BURNERS; MECHANICAL PRESSURE ATOMIZING OIL BURNERS; LOW AIR PRESSURE OIL BURNERS; GAS BURNERS; COMBINATION GAS and OIL BURNERS; AUTOMATIC OIL BURNERS, for small process furnaces and heating plants; FUEL OIL HEATERS; FUEL OIL PUMPING and HEATING UNITS; FURNACE RELIEF DOORS; AIR INTAKE DOORS; OBSERVATION PORTS; SPECIAL REFRACTORY SHAPES.

NATIONAL AIROIL BURNER CO., INC.

Main Offices & Factory: 1298 EAST SEDGLEY AVENUE, PHILADELPHIA 34, PA.

SOUTHWESTERN DIV.: 2512 SOUTH BOULEVARD, HOUSTON 6, TEXAS

INDUSTRIAL OIL BURNERS, GAS BURNERS, FURNACE EQUIPMENT

EATON

2-Speed Truck

AXLES Make Trucks Last Longer

Reduce Maintenance Costs

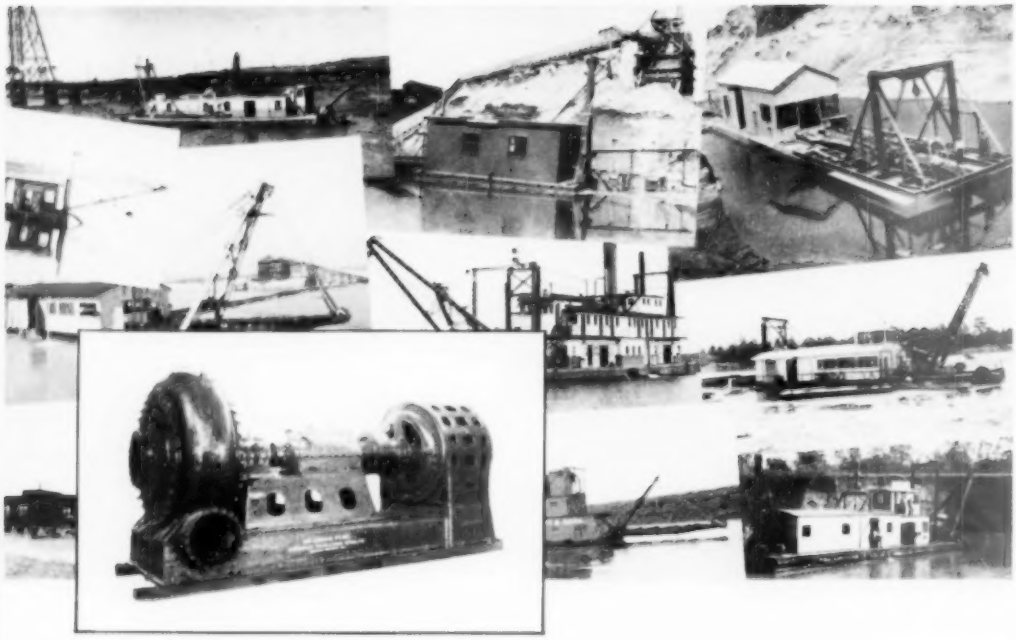
Because they double the number of gear ratios available on any truck, Eaton 2-Speed Axles permit the use of an efficient ratio for every operating condition. From "low low" for starting under full load to "high high" for empty return trips, the driver can select the ratio that puts the least stress on the engine and power transmitting units. As a result, maintenance costs are decreased and truck life is increased. Ask your truck dealer to show you how Eaton 2-Speed Axles more than pay for themselves on the 1½-ton and larger trucks for which they are available.

Axle Division

EATON MANUFACTURING COMPANY

CLEVELAND, OHIO

EATON **PRODUCTS:** SODIUM COOLED, POPPET, AND FREE VALVES • TAPPETS • HYDRAULIC VALVE LIFTERS • VALVE SEAT INSERTS • JET ENGINE PARTS • ROTOR PUMPS • MOTOR TRUCK AXLES • PERMANENT MOLD GRAY IRON CASTINGS • HEATER-DEFROSTER UNITS • SNAP RINGS SPRINGTITES • SPRING WASHERS • COLD DRAWN STEEL • STAMPINGS • LEAF AND COIL SPRINGS • DYNAMATIC DRIVES, BRAKES, DYNAMOMETERS



in suction dredging . . .

More owners buy AMSCO® than any other pump!

Here's why so many operators find that AMSCO Pumps make dredging more profitable

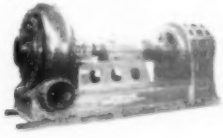
The dredges shown above are typical of over a thousand that have one feature in common . . . they're equipped with Amsco Manganese Steel Dredge Pumps. In fact, almost any operator will tell you that an Amsco Pump is the one to buy.

Why this outstanding preference? First, because profitable dredging requires high efficiency . . . second, because service records prove beyond question that tough manganese steel is the answer for long-wearing, trouble-free pump performance. *An Amsco Pump wins the profit battle against impact and abrasive wear.*

When you handle aggregate with equipment that *lasts longer* . . . that does the job with *greater efficiency* . . . you make *higher profits.* That's why more Amsco Manganese Steel Dredge Pumps are in use than any other make or type.

Amsco has the pump you need—large or small. Write today for the facts.

AMSCO®
Dredge Pumps



AMERICAN **Brake Shoe** COMPANY

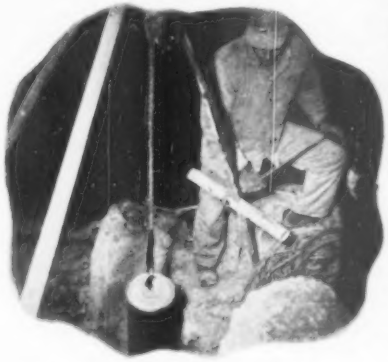
AMERICAN MANGANESE STEEL DIVISION
377 EAST 14th STREET • CHICAGO HEIGHTS, ILL.

Other Plants: New Castle, Del., Denver, Oakland, Cal., Los Angeles, St. Louis. in Canada: Joliette Steel Division, Joliette, Que.

FRAGMENTATION..EXCELLENT!

Safe, easy-to-follow Du Pont Quarry Blasting Plan cuts production costs for Virginia quarry

THE DU PONT QUARRY BLASTING PLAN was employed at the Superior Stone Company's Red Hill granite quarry with outstanding results. Since the rock was exceptionally hard, Du Pont "Nitramex"* was used exclusively. "Nitramon" Primer, Primacord and electric blasting caps detonated the charge.



LOADING PROGRESSED SMOOTHLY. A total of 71,481 pounds of "Nitramex" was loaded into 16 well drill holes, ranging from 170 to 200 feet in depth with an average burden of 30 feet. Circuit wires were attached to a Du Pont Blasting Timer set for intervals of .015 second between holes. The shot was fired by remote switch.

EXCELLENT FRAGMENTATION with little back break characterized the blast which brought down a volume of 82,800 cubic yards of rock. Results of this calibre have proved the Du Pont Quarry Blasting Plan most economical in many types of quarries, including shale, limestone, cement and trap rock. Ask your Du Pont Explosives representative for complete information about this better, safer blasting plan today. E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Delaware.

*"Nitramex" is well known for its safety, ease of handling and non-headache-producing qualities.

"Nitramex" is a registered trade-mark for Du Pont ammonium nitrate blasting agent.

DU PONT

BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

DU PONT EXPLOSIVES

Blasting Supplies and Accessories

The 3' x 6' Model C, Single Deck Screen

The biggest screen for the smallest dollar

The Simplicity 3' x 6' Model C Single Deck Screen is without question the biggest screen value available on the market today, and it has always been the lowest priced screen of real capacity ever offered. The 3' x 6' screen *actually gives 3' x 6'* — 18 square feet — of screening area with the famous Simplicity Gyrating Action. This Model C single deck screen is a standard unit *built for service in any industry*. Ideal for cleaning up a dirty stockpile or for making an extra size product outside your regular screening operations. The 3' x 6' Model C has all the work-proved Simplicity features, yet is a compact unit that can be installed in your aggregate operation at a saving you won't find elsewhere.

Sales representatives in all parts of the U. S. A. FOR CANADA: Canadian Indus Engineering Co. Ltd., Walkerville, Ontario. FOR EXPORT: Ilmore and Sims, 50 Church Street, New York 7, N. Y.

Simplicity
TRADE MARK REGISTERED

ENGINEERING COMPANY • DURAND, MICHIGAN

CHEVROLET

ADVANCE-DESIGN TRUCKS

POPULARITY LEADERS Chevrolet trucks are the favorites by far! In every postwar year truck users have bought more Chevrolets than any other make. And that's proof of the owner satisfaction they have earned!

PERFORMANCE LEADERS Chevrolet trucks give you high pulling power over a wide range of usable road speeds . . . cut down total trip time with high acceleration on the straightaway.

PAYLOAD LEADERS Careful design and rugged construction permit you to haul more goods more miles—at lower cost per ton mile! You enjoy real savings on operating and repair costs.

PRICE LEADERS You're money ahead with Chevrolet trucks! Chevrolet's rock-bottom initial cost—outstandingly low cost of operation and upkeep—high-trade-in value, all add up to the lowest price for you.

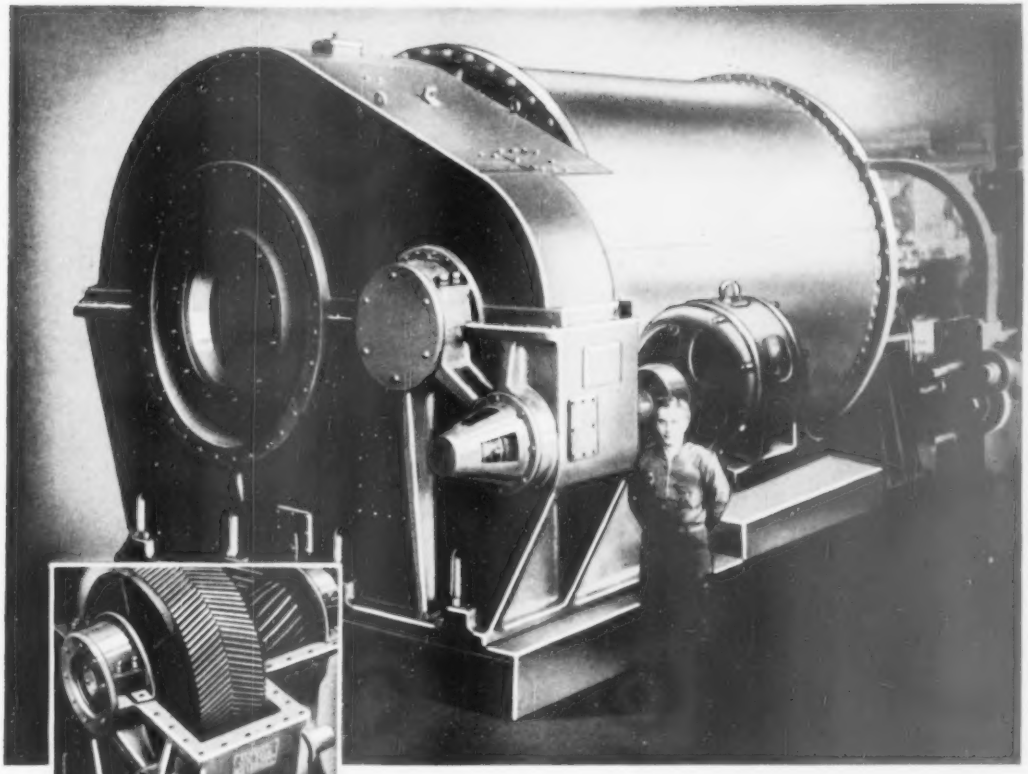
Packed with VALUE... *Primed with* POWER

Chevrolet Advance-Design trucks have everything it takes—and plenty to spare. Rugged construction to withstand the wear and tear. Handling ease and comfort to lighten the load of a day's work. And more power than ever! Two great Valve-in-Head engines—the Loadmaster 105 h.p. and the Thriftmaster 92 h.p.—make these the most powerful trucks Chevrolet has built! Yes, these new jobs bring you peak value—and at a low price. They cost surprisingly little to buy, to run and maintain. That's why Chevrolet trucks outsell them all!

CHEVROLET MOTOR DIVISION, *General Motors Corporation*, DETROIT 2, MICH.

AHEAD WITH ALL THESE PLUS VALUES

• TWO GREAT VALVE-IN-HEAD ENGINES: the New 105-h.p. Loadmaster and the Improved 92-h.p. Thriftmaster—to give you greater power per gallon, lower cost per load • THE NEW POWER-JET CARBURETOR: smoother, quicker acceleration response • DIAPHRAGM SPRING CLUTCH for easy action engagement • SYNCHRO-MESH TRANSMISSIONS for fast, smooth shifting • HYPOID REAR AXLES—5 times more durable than spiral bevel type • DOUBLE-ARTICULATED BRAKES—for complete driver control • WIDE-BASE WHEELS for increased tire mileage • ADVANCE-DESIGN STYLING with the "Cab that Breathes" • BALL-TYPE STEERING for easier handling • UNIT-DESIGN BODIES—precision built.



NO RENEWALS, NO REPLACEMENTS

--bearings by SKF

Used in the final pulverizing action of limestone and coal, this 10-ft. Kennedy-Van Saun Integral Gear Driven Mill offers real power savings. It's a massive machine that *stays* on the job. Installed in hundreds of plants, these mills have not required renewal or replacement of gears or pinions—even after years of operation.

And gears and pinions are mounted in roller bearings—are always held in perfect alignment—and mesh properly.

Here again, SKF has helped to put the right bearing in the right place.

It's the natural result of SKF's continuing policy of research and development, strict control of every step of manufacture, refusal to compromise with quality in any way. **SKF** INDUSTRIES, INC., PHILADELPHIA 32, PA.—*the Pioneers of the Deep Groove Ball Bearing, Spherical Roller Bearing, Self-Aligning Ball Bearing.* 7146

SKF

BALL AND ROLLER BEARINGS

8 REASONS WHY SKF IS PREFERRED BY ALL INDUSTRY

Integrity · Craftsmanship · Metallurgy · Tolerance Control · Surface Finish · Product Uniformity · Engineering Service · Field Service

THE DEMPSTER-DIGGSTER, Type GRD, same as the one that loaded 600 tons of stone recently, has a 15 foot six inch turning radius, is 20 feet long when bucket is in traveling position, and bottom of bucket is nine feet three inches above ground when in extreme dumping position. It will dig 15 inches below grade and through a 15 foot bank. Note how bucket follows the slope of the material.

THIS DEMPSTER-DIGGSTER, Type HL, is specially equipped for high dumping. The bottom of the bucket is 13 feet six inches above ground. It will dig through an 18 foot bank.

FOR FAST, EFFICIENT operation in difficult terrain, the Dempster-Diggster is available with crawler-type traction.

Fast Automotive Shovel Loads 600 Tons of Stone in Half a Day

CONTRACTOR REPORTS: HYDRAULIC CROWD, HOIST UNIT "FILLS LONG NEEDED PLACE IN OUR INDUSTRY"

THE DEMPSTER-DIGGSTER, a revolutionary shovel loader, recently loaded 600 tons of broken stone in the first half day of operation. This outstanding performance was reported to Dempster Brothers, Inc. by W. E. Lambert, president of Lambert Brothers, Inc., one of the nation's largest crushed stone contracting firms.

"In connection with our extensive activities in several southern states," the contractor said, "we have used various types of power shovels and front end loaders. After seeing the easy operation of the hydraulically operated Diggster in a demonstration we had made alongside of a competing loader, we placed an order with you. We installed the Diggster equipped with a yard and half stockpile bucket on one of our operations in western North Carolina.

"Our records show," he continued, "that the unit loaded approximately 600 tons of broken stone in the first half day of operation. The Diggster has been working continuously and is giving perfect satisfaction. It is a pleasure for us to so advise you because in our opinion the Diggster fills a long needed place in our industry. We welcome you to bring any interested parties to our operation to see the Diggster in action."

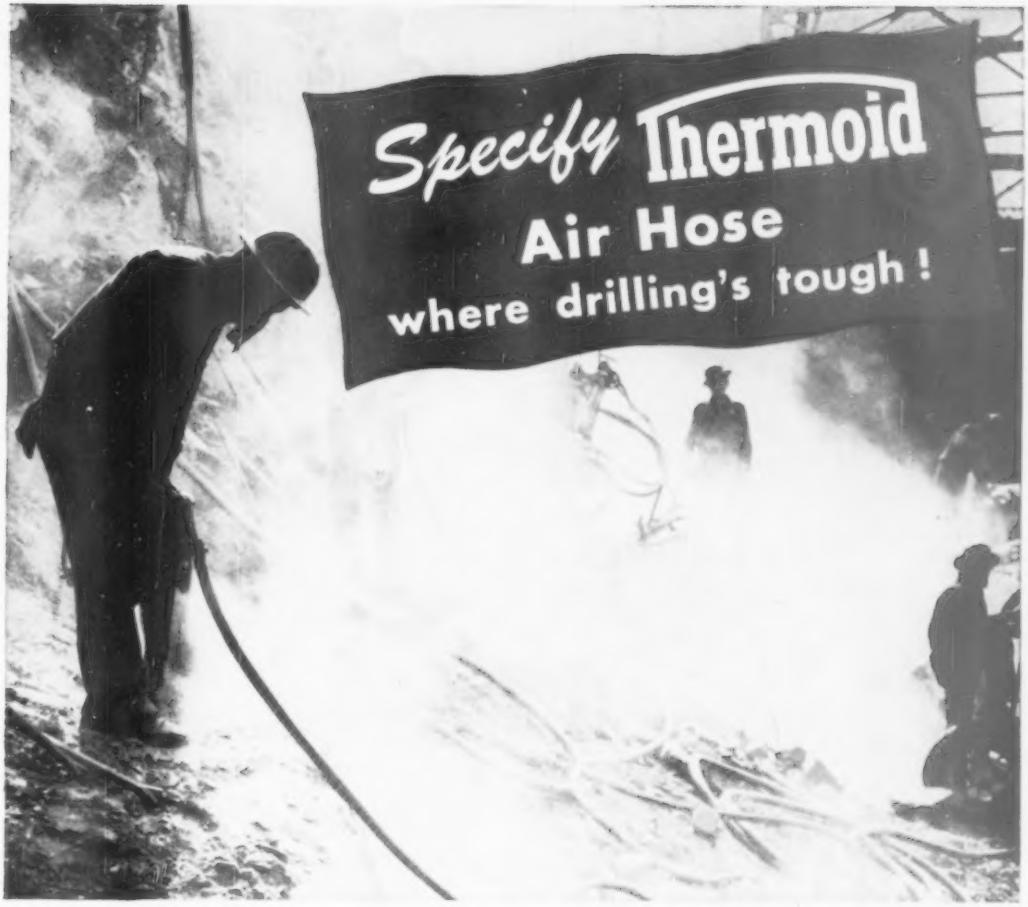
The tremendous speed of the Dempster-Diggster in excavation and stockpile work is accounted for, mainly, by its exclusive independent hydraulic crowd and hoist action, the hydraulic steering, and wheel-type traction, which permits truck speeds to and from jobs. The power crowd permits bucket to keep digging until loaded . . . no digging with wheels. The hydraulic steering gives the driver easy, fast, finger-tip control.

Four standard interchangeable buckets of two types are available. Digging buckets with four bottom teeth in 1 and $1\frac{1}{4}$ cubic yard (heaped) capacities; materials handling buckets in $1\frac{1}{2}$ and 2 cubic yard (struck) capacities.

Complete information and prices may be obtained by writing the manufacturer, Dempster Brothers, Inc.

DEMPSTER DIGGSTER

DEMPSTER BROTHERS
380 N. Knox
Knoxville 17, Tennessee



Thermoid Research Gives Greater Flexibility and Wear-ability to New-Type Hose!

Thermoid has designed *Thermine* Air Hose especially for more efficient and economical use in drilling operations—from construction jobs to mining.

Increased flexibility allows greater freedom of movement and permits bending the hose easily around tight corners. A heavy synthetic rubber oil-proof tube is reinforced with heavy braided rayon cord. Smooth, extra-heavy rubber cover offers maximum resistance to abrasion and cutting by sharp rocks.

Thermine Air Hose is mandrel-built from $\frac{1}{4}$" to $1\frac{1}{2}$" inclusive in 50 ft. lengths. Available at your nearest Thermoid Distributor.

Thermoid Quality Products: Transmission Belting • F.H.P. and Multiple V-Belts • Conveyor Belting • Elevator Belting • Wrapped and Molded Hose • Molded Products • Industrial Brake Linings and Friction Materials.

For *Complete* Satisfaction *Specify* Thermoid!

Thermoid Company

Main Offices and Factory • Trenton, N. J., U. S. A.
Western Offices and Factory • Nephi, Utah, U. S. A.
Industrial Rubber Products • Friction Materials • Oil Field Products

20 Years of Continuous Service

HARRY F. NASH, PRESIDENT AND GENERAL MANAGER

TELEPHONE MAIN 5111 BRANCH 234

THE LEYDEN LIGHTNING COMPANY

1 Tramway Bldg. . . LEYDEN NATURE MADE GOOD COAL . . Denver 2, Colorado

April 1st, 1950

A. R. Wilfley & Sons,
Denham Building,
Denver, Colorado.

Gentlemen:

I understand that your Mr. Elmer Wilfley is out of the City and upon his return I wish you would show him this letter and express to him our appreciation of the fact that this pump was [illegible] to the Leyden Lignite Company over twenty years ago and it has been in continuous service ever since with no repairs - a remarkable achievement.

Youre very truly,

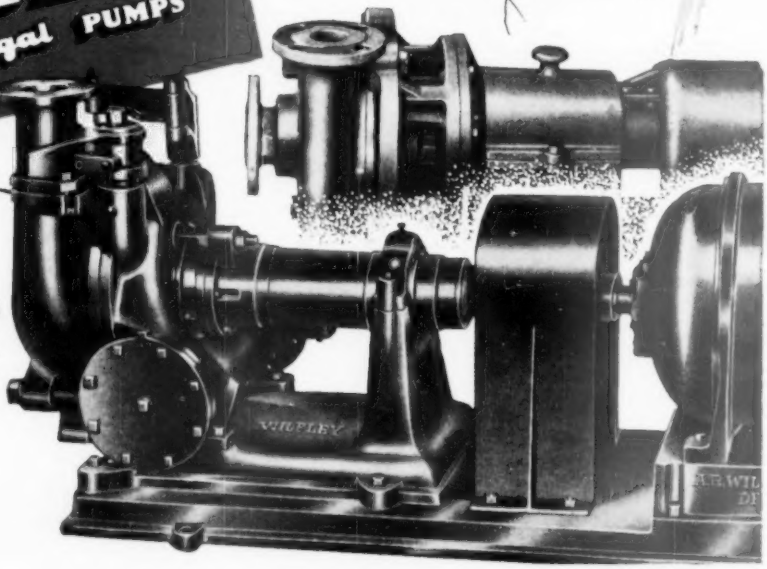
THE LEYDEN LIGHTNITE COMPANY,

BY Harry F. Nash
President and General Manager.

Dependability, efficiency and cost-saving economy are built-in features of *every* WILFLEY Sand and Acid Pump. Individual engineering on every application. Write or wire for complete details.

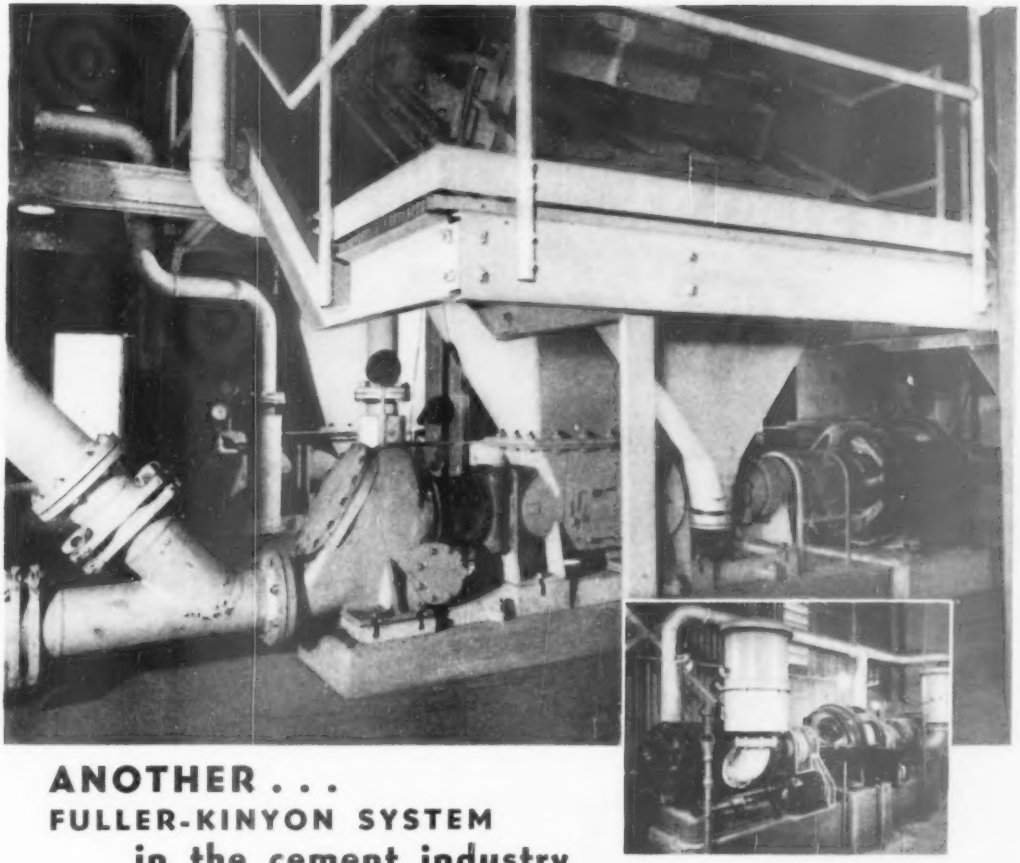
Buy WILFLEY for Cost-Saving Performance

WILFLEY *centrifugal* **PUMPS**



A. R. WILFLEY & SONS
INC.
DENVER, COLORADO, U. S. A.

New York Office:
1775 Broadway
New York City, N. Y.



ANOTHER . . .
FULLER-KINYON SYSTEM
in the cement industry

Following the general practice, of practically all cement plants in this and many other countries, when this mid-western cement company decided to extend its storage and bulk-loading facilities, it again selected the Fuller-Kinyon System as the most efficient and economical conveyor. Two Type L Pumps were installed to convey cement from the finishing mills to three sets of silos . . . maximum conveying distance 1385 feet; capacity of each pump, 376 barrels an hour.

Air for the Conveying System is furnished by two Fuller Rotary Duplex Single-stage Compressors, each of which has a capacity of 2010 c.f.m. at 35 psig.

Cement plants throughout the country have found that the combination of Fuller-Kinyon Pumps and Fuller Rotary Compressors, provide by far the most efficient, trouble-free and economical method of conveying yet developed. Air, at the proper pressures to handle the job at minimum cost and maintenance, is always available where and when it is needed.

To call in a Fuller Engineer to survey your present conveying system places you under no obligation. It may be your long first step toward more efficient and profitable operation.

DRY MATERIAL CONVEYING SYSTEMS AND COOLERS—COMPRESSORS AND VACUUM PUMPS—FEEDERS, AND ASSOCIATED EQUIPMENT

fuller

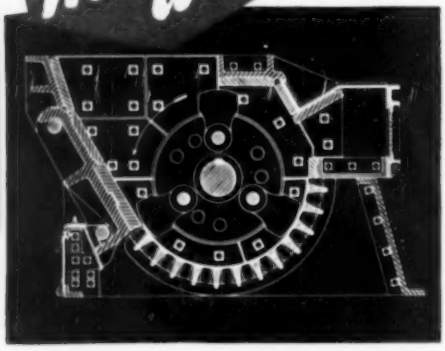
FULLER COMPANY, Catasauqua, Pa.
120 S. LaSalle St., Chicago 3
420 Chancery Bldg., San Francisco 4

P-117

25% to 75% SMALLER INVESTMENT

with a Williams "Super-Slugger" Crusher

Here's why



Feed opening 41"x 30" to 51"x 81". Hammer blows 10,800 blows per minute in the smallest size, each blow 1,285,200 foot pounds to 17,280 blows per minute in the largest size, each blow 2,893,760 foot pounds. Size of product quickly changed by using grates with smaller openings.

because it reduces power shovel loaded rock to 1½ inch or ¾ inch in one operation

In one operation! That means not only a saving in machinery, less depreciation by wear and tear, but the additional savings of foundations, conveyors, drives and buildings. Because the Super-Slugger is a heavy duty hammermill that can crush power shovel loaded rock down to feed size for fine grinding or to commercial crushed stone. Built to do a giant sized job because it's heavily reinforced at all parts subject to shock and wear . . . with extra heavy manganese steel liners. Shafts of unusually large diameter. The Super-Slugger is a real payload and profit builder! For detailed information write for bulletin 634.

WILLIAMS PATENT CRUSHER & PULVERIZER CO.
800 ST. LOUIS AVENUE — ST. LOUIS 6, MISSOURI

WC-48-4

WILLIAMS ALSO MAKES—

Heavy-duty hammermills in smaller sizes for all quarry operations; impact and roller mills for 200 to 325 mesh grinding; drier mills; air separators; vibrating screens; steel bins; complete "package" crushing and grinding plants.

WILLIAMS

CRUSHERS — GRINDERS — SHREDDERS

More than 19 years continuous quarry service for this sturdy PLYMOUTH LOCOMOTIVE

Beginning its 20th year of efficient service at the Wagner Quarries Co., Sandusky, Ohio, this rugged PLYMOUTH Locomotive continues to operate on a steady 48-hr. per week schedule. Mr. W. J. Sprow, Jr., Vice President, reports that, despite long years of routine hauling and switching on the quarry's 5-mile track, maintenance requires very little more than ordinary routine servicing.

Dependability that lasts for YEARS . . . that's the direct result of PLYMOUTH Engineering, rugged PLYMOUTH stamina. Quarries everywhere have learned the profit-making advantages of PLYMOUTH service, year after year . . . on roughest hauling jobs.

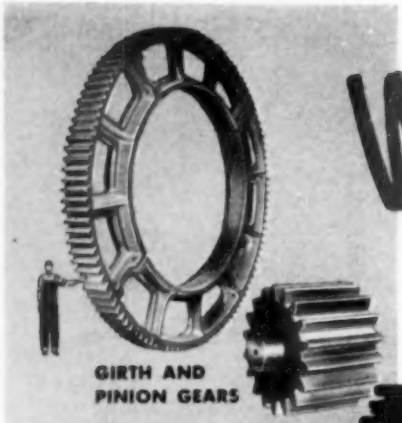
No matter what your hauling or switching needs might be, there's a PLYMOUTH engineered to keep production costs low, and increase the net profits of your operation. Available in gasoline, diesel-mechanical, diesel-electric . . . standard or narrow gauge . . . 2½-ton to 70-ton models.

Write for descriptive catalog of all PLYMOUTH models . . . complete details of how YOU can cut hauling and production costs with PLYMOUTH! Write today! PLYMOUTH LOCOMOTIVE WORKS, Dept. A-5, DIV. OF THE FATE-ROOT-HEATH COMPANY, PLYMOUTH, OHIO.

PLYMOUTH LOCOMOTIVES

GASOLINE, DIESEL, AND DIESEL ELECTRIC

PLYMOUTH LOCOMOTIVE WORKS • Division of The Fate-Root-Heath Co., Plymouth, Ohio, U.S.A.



Wear Resistant Stroh

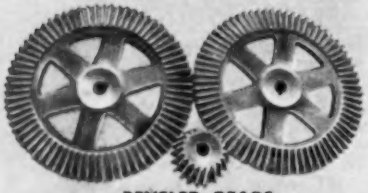
REPLACEMENT PARTS

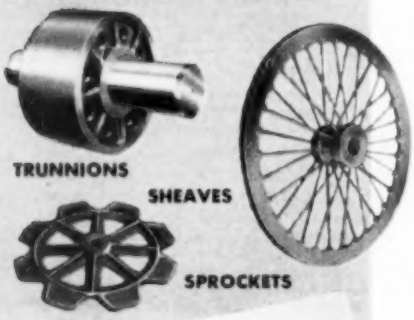
for Long-Life Service on

Kilns	**Rod Mills**	**Compeb Mills**
Coolers	**Tube Mills**	**Crushers**
Dryers	**Ball Mills**	**Classifiers**

Other Similar Equipment

Since 1916!





- PRESSURE PARTS
- CRUSHER ROLLS
- JAW PLATES
- CRANE WHEELS
- RACKS AND PINIONS
- CUT TOOTH GEARS
- SHEAR BLADES
- TABLE GEARING

Specialists in the fabrication of gears, tires, trunnions, sprockets and allied parts for kilns, coolers, dryers, ball mills and similar processing equipment . . . Stroh engineers have perfected a method of applying a high grade, wear-resistant alloy steel to *the wearing surfaces* only of plain carbon steel. Proved in service . . . replacement parts by Stroh assure you of maximum service life . . . economical, smooth operation of equipment. Let us show you case studies of outstanding performance. A representative will gladly call at your request, or we will quote on your requirements on receipt of your inquiry.

WRITE TODAY FOR CATALOG!

Stroh PROCESS STEEL CO.

Established 1916

PITTSBURGH 12, PENNA., U. S. A.

WALLACE YOUNG, South American Representative

Manufacturers of STROH ALLOY CAST TOOTH GEARS
CAST OR CUT TOOTH CARBON STEEL GEARS

This Belt Takes a Terrific Beating

Manhattan Conveyor Belts are Built to Take It

This 30" Manhattan Conveyor Belt is handling hot filtered cement. Slurry conveyors such as this are notoriously tough on belts, but this Manhattan installation in an Oklahoma cement plant is paying for itself over and over.

Manhattan engineers are "Belting Pioneers" when it comes to designing conveyor belts for special duty.

HOMOCORD — Special Cushioned Construction . . . Only for Conveyor Belt Use

In Homocord Conveyor Belt, Manhattan engineers devised a Strength Member that gives with the shocks of loading and dissipates hard blows. It has been called a "Rippling Muscles Construction" because the Homocords have a flexible, resilient, rolling action with each other. Homocord Conveyor Belt is Cushioned, Tough, Flexible and Mildew-Proof, also holds metal fasteners.

RAY-MAN — for Extra Long Lifts

Another Manhattan "First", built with Rayon Cord Strength Members. A "Tension Master" construction for longer lifts where you want to eliminate troublesome transfer points.

Whatever your conveyor belt needs, call a Manhattan Conveyor Belt Engineer to advise you on possible ways to lower your stone and aggregate handling costs.

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Manufacturers of Mechanical Rubber Products • Rubber Covered Equipment • Radiator Hose • Fan Belts • Brake Linings • Brake Blocks • Clutch Facings • Packings • Asbestos Textiles • Powdered Metal Products • Abrasive & Diamond Wheels • Bowling Balls

LOOK AT THE RECORD

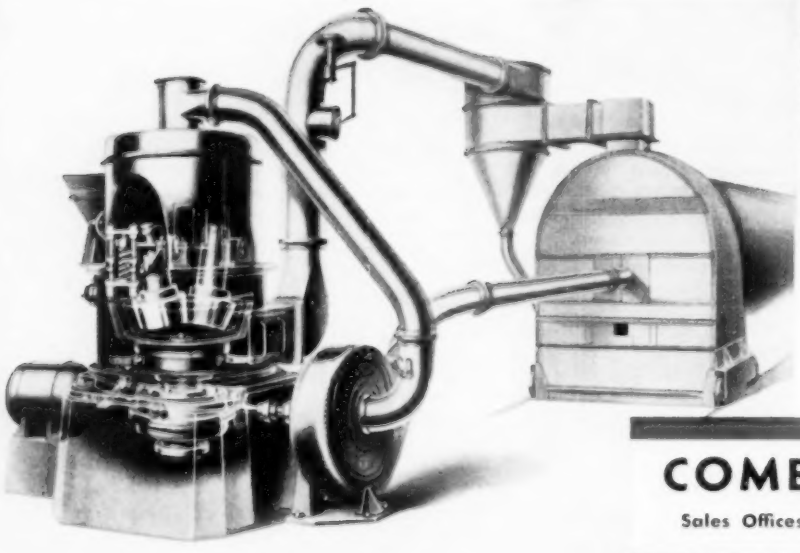
SINCE its first installation in 1935, the Raymond Bowl Mill has won industry-wide recognition throughout the cement, lime, burned dolomite, and similar fields for direct firing rotary kilns with pulverized coal.

The fifteen year record on the opposite page, shows the steady increase in the use of Bowl Mills in these industries. From the original three units installed in 1935, the list has grown to over 250 units in 1950 for firing rotary kilns alone, with a rated capacity of nearly 2½ million pounds of coal per hour and equivalent to 10,852,764 *tons* per year.

The continued leadership of the Raymond Bowl Mill is based on its proven ability to reduce over-all costs and insure top efficiency in kiln operations.

Write for Bowl Mill Catalog No. 62.

The Raymond Bowl Mill provides a complete, fully coordinated system of coal grinding and direct firing for rotary kilns.



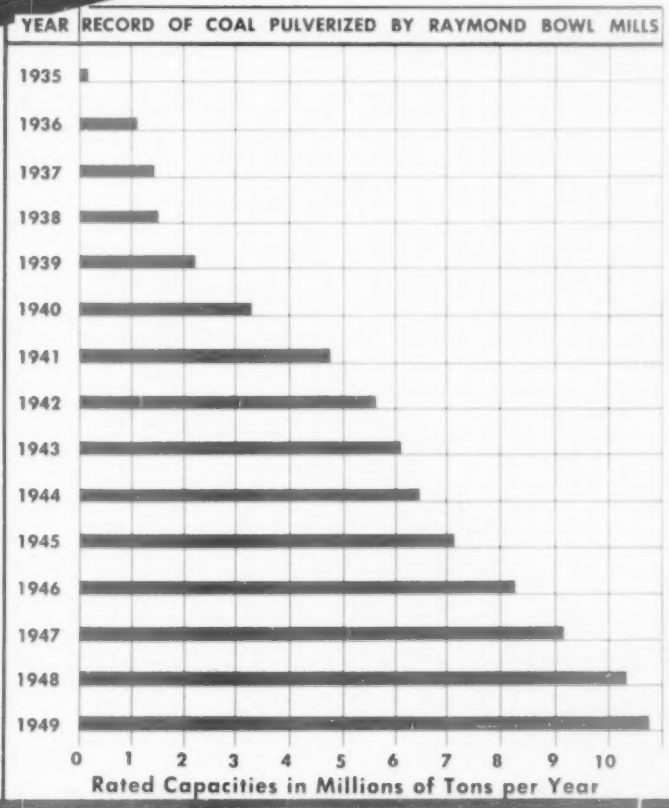
COMBUSTION

Sales Offices in Principal Cities

# of RAYMOND BOWL MILLS

Over . . .
10 Million Tons
Rated Capacity of Coal pulverized per year in the Cement, Lime and burned Dolomite fields alone

Increase in Yearly Rated Capacities



ENGINEERING-SUPERHEATER, INC.
RAYMOND PULVERIZER DIVISION
1307 North Branch Street ● Chicago 22, Illinois

"WE HEAR..."

August, 1950

Development of a tough new plastic which may become one of the basic raw materials of the rubber industry has been announced by the U. S. Rubber Co. The new plastic bridges the gap between soft rubber and hard rubber and will fill a need for a high strength material that is resistant to abrasion and chemicals and at the same time can be produced in varying degrees of flexibility. Gears made of the new plastic are said to have operated for more than a year in applications where conventional gears have failed within a few weeks.

* * * * * * * * *

Employment in the next two years will stay at least as high as the 1948 all-time peak and has a good chance of surpassing it, without war, some observers believe. Unemployment, which hit its peak in February, is steadily going down. Employment hit a 17-month peak of 61,482,000 in June. The labor reserve is now down to 3,384,000.

* * * * * * * * *

Some authorities in Washington think May will prove to have been the peak month of the housing boom, and that there will be a tapering off the rest of the year. May recorded 140,000 starts, an all-time, all season record. Regardless, 1950 will break all records with starts perhaps 200,000 over last year's record of 1,025,000. Spending for new construction will total nearly $26 billion, 14 percent over last year's totals. Outlays for all construction in the first half of 1950 totaled $11,700,000,000, 17 percent above the 1949 total.

* * * * * * * * *

A plant is being set up near Cincinnati, Ohio, to process and mill critical and strategic minerals from Florida sands. Various types of sand will be shipped in from the Melbourne area of Florida and converted into products for use in printing inks, paper, rubber, paint pigments and other commercial items.

* * * * * * * * *

Lack of freight cars has been called perilous by Monroe Johnson, chairman of the Interstate Commerce Commission, who directed rail traffic during the last war. He has warned that the railroads' stock of freight cars is far below the nation's defense requirements. He said it would take three or four years of top production to build up the railroads' rolling stock to the point where the roads could handle a new war emergency.

* * * * * * * * *

Waste lime has been named as the "likely" cause of the death of thousands of fish in the south branch of the Shenandoah river. A broken dike around a waste lime storage pond has been blamed for the river pollution. In two days some 15,000 to 18,000 fish were estimated to have died.

* * * * * * * * *

For the first time in 18 months, business spending on new plant and equipment is heading upwards, following a long, slow decline. U. S. Securities & Exchange Commission and U. S. Department of Commerce have estimated business will spend $12.7 billion for new plant and equipment in the first nine months of 1950, or some six percent less than was spent in the same period last year. In January, the agencies had forecast such capital spending would be down 11 percent.

WE HEAR

This year's total industry volume of all rubber products should reach an estimated $3.4 billion, up $200 million from 1949. Consumption of new rubber will total 1,070,000 tons, including 650,000 tons of natural and 420,000 tons of synthetic. This would compare with 575,000 tons of natural and 414,000 tons of synthetic in 1949. Rubber manufacturers see little likelihood of an easing in the tightness of natural rubber.

* * * * * * * * *

A 7.8 percent increase in Midwest carloadings in the third quarter of 1950 has been predicted by the Midwest Shippers Advisory Board. Freight carloadings in July, August and September, 1950, are expected to be 872,533 cars compared with 809,398 cars in the like 1949 period for the same commodities. Cement is expected to show an increase of 8 percent.

* * * * * * * * *

Latest plan being studied to get water to the Southwest calls for rerouting water from the Columbia River, carrying it 1000 miles south from the northern border of Oregon, and then flowing it into the arid southern California. The rerouted Columbia water probably would be carried through canals, tunnels and aqueducts into the Sacramento basin, then down the Sacramento into the San Joaquin, and then through tunnels again through the hills to the final users.

* * * * * * * * *

Industrial production approximately equalled the 1948 peak during June. The auto industry may produce 8,000,000 cars and trucks this year for an all-time record. The steel industry expects to be strong until late autumn. Machine tool orders in May were the highest in four years.

* * * * * * * * *

Waste lime sludge from carbide production will be used to make more carbide in a $500,000 experimental plant soon to be built at Louisville, Ky., by National Carbide. Lime sludge, now a waste product, will be pelletized with coke, and the pellets charged to the electric furnaces at the present plant to be converted into calcium carbide. The new process is expected also to minimize dust.

* * * * * * * * *

Industrial diamonds for the U. S. Government stockpile will be mined in a remote area of Africa as the result of Marshall Plan aid. The Economic Co-operation Administration has announced an agreement with the French Government under which E.C.A. has concluded commercial contracts designed to aid in the development of the most advanced mechanized diamond mines in French Equatorial Africa.

* * * * * * * * *

Freight carloadings for the week ended June 24 were higher than for any single week since November, 1948. The Association of American Railroads reports that 810,152 cars were loaded during that week.

* * * * * * * * *

Some $20,000,000 is in the process of being spent on labor and material to improve Oklahoma's road system. As of the close of May, the highway commission had $24,555,000 worth of roads and bridges under contract, and about 80 percent of that amount was under construction. Since then, the commission has contracted for more than $4,000,000 more road improvements.

* * * * * * * * *

By the year's end, U. S. contractors probably will have done 25 percent more construction business than last year and 12 percent more than they did in 1948, the record year. Based on that, 1950 is expected to top out at around $1.1 billion worth of road contracts put under construction. A rush to let highway contracts early in the winter and spring has pushed volume 56 percent higher than a year ago.

THE EDITORS


DEPENDABLE
is the word that best describes
KRAFT made-to-order
heavy-duty multi-wall
shipping sacks
produced in our new plant at St. Marys, Georgia
DEPENDABLE bag paper . . . made to exacting specifications in our own mill
DEPENDABLE bag design . . . by our own practical packaging engineers
DEPENDABLE workmanship . . . by personnel with long experience in multi-wall bag construction
DEPENDABLE plate-making, and dependable printing with improved presses and inks
DEPENDABLE deliveries and service . . . by rail or water right from our own doorstep.
• Sewn or pasted—valve or open mouth—2 ply or up to 6 ply . . . you can depend on "Kraft" both as a source of supply and as a source of complete satisfaction.
KRAFT BAG CORPORATION
A DIVISION OF GILMAN PAPER CO
630 Fifth Ave., New York 20, N.Y.
Western Sales Office
Daily News Bldg., Chicago 6, Ill.
KRAFT BAG CORPORATION
Gilman PAPER CO.
• St. Marys Kraft Corp.
• Gummed Tape Div.
• The Gilbreath Corp.
• Kraft Bag Corp.
The long, white building in the foreground is the newly completed addition to the Kraft Bag Corporation's plant in St. Marys, Georgia
Send your product to market in a "KRAFT BAG"—the container for a thousand uses!

★ ★ ★ Editor's Page

Legality of Freight Absorption Remains a Confused Issue

BASING POINTS and the question of legality in the absorption of freight, in quoting delivered prices to meet bona fide competition, have been given quite a mulling over since President Truman's veto of the bill, S.1008. The bill was designed to remove uncertainties that have confounded the heavy goods industries since the 1948 ruling by the Supreme Court against the cement industry.

The Presidential veto, which came as a surprise in view of the caliber of support for the bill, had the effect of leaving the portland cement industry, among steel and others, still confused. Legally, nothing has been changed after two years of agitation and work toward writing clarifying federal legislation, and there is much doubt that such action will be taken in the next session of Congress.

The way the law stands now, freight absorption and delivered pricing, by individual companies, in the absence of collusion, conspiracy or planned joint courses of action, is legal. Basing point pricing is still illegal practice. The rub is that the F.T.C. very likely will continue to cite industries in which basing points or other freight equalization plans result in identical prices for all producers of a standard product. Should a cement manufacturer be willing to reduce delivered prices, at the sacrifice of decent profits or maybe even by assuming a temporary loss in order to meet a competitor's price within any given market, it isn't reasonable that fear of legal action should compel him to quote a price below the lowest competitive price. By meeting that price, he remains open to suspicion of collusion and must regard such price quotation as hazardous practice.

No Bar to Absorption?

It has been construed by Senator O'Mahoney, principal sponsor of bill S.1008, that the president's statement, "It is quite clear that there is no bar to freight absorption or delivered prices as such," amounts to instruction to the F.T.C. not to start action against any seller who, acting individually, and without combination or conspiracy, adopts either practice. Maybe that's a correct interpretation but a good number of cement manufacturers are skeptical and hesitate to rely upon it. Others are taking the statement at its face value, as an endorsement of pricing practices, based on freight absorption, which they have continued to follow because they have believed they always have been within the law.

Senator O'Mahoney was encouraged also by the Truman statement, "I recognize that businessmen have been concerned lest they be penalized for perfectly sensible and appropriate competitive action. I believe their concern is unwarranted." He believes there is an inference in the president's statement, that sellers who reduce prices for competitive reasons, without any proof of an existing danger of substantially lessening competition or tending to create a monopoly, are not jeopardized.

That may be but, on the advice of legal counsel, some cement manufacturers who are presently absorbing freight where needed are keeping records, case by case, of the circumstances for all variations from f.o.b. mill price plus total freight to destination. The majority of cement manufacturers are presently quoting f.o.b. mill prices plus freight (see lead cement article in this issue) but it is likely that freight will be absorbed when the competitive fight, between companies, to stay in business, resumes with return of a buyers' market. That's when the test will come, and within other heavy goods industries as well, when the F.T.C. must decide whether or not real honest-to-goodness competition is to be permitted.

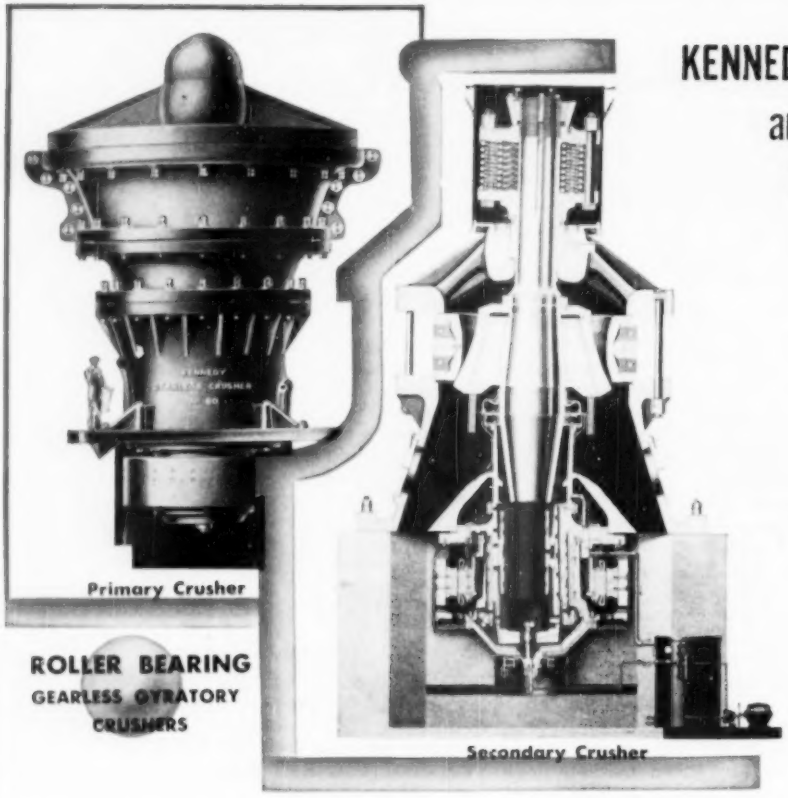
What Monopolies?

It was feared by the president that passage of the pricing bill, S.1008, would result in reducing competition and be detrimental to small business and the public interest. That's what we have had with straight f.o.b. mill plus total freight pricing. Concrete products and ready-mixed concrete producers, among other buyers of cement, could well say in many instances that the prices that they have had to pay for the cement that they could get have upset competitive conditions in their markets. The reason more hasn't been said about that has been that the "prosperous" public has been willing to pay through the nose.

The political side of the issue has now come out more in the open. Those in Washington who opposed passage of the bill are now afraid that President Truman's statements, that appear to give the go-ahead to industry to absorb freight, will discourage de-centralization of industries, which is what they have sought for the benefit of their supporters. The uninformed in influential positions believe that a cement mill can be established anywhere without regard for sources of raw materials and other economic facts.

Bror Nordberg

IT COSTS LESS TO OWN THE BEST!



KENNEDY CRUSHERS are really . . . . **Rugged!**

Synchronous motor built into pulley assembly

•

Power applied ONLY for crushing

•

Force-feed lubrication

•

No gears to waste power

•

Added power at no added cost

•

Quiet — smooth Frictionless action

•

Varying capacities to serve every purpose

Designed and built to produce, economically and consistently, maximum loads of uniform products. Assures efficient service with minimum "time off for repairs" under the most severe operating conditions.

Costs less in the long run because it has a larger capacity; uses less power; holds repair bills to a minimum; produces more and better rock tonnage, faster and at lower cost.

Kennedy Crushers are made in various size units delivering from 12 to 3600 tons per hour. Engineered to serve your exact needs. Fifty years experience in the building of heavy duty crushers is your assurance that "It Costs Less To Own The Best" when you use KVS equipment.

Send for bulletins describing, fully, all types of KVS crushers

KENNEDY-VAN SAUN MFG. & ENG. CORPORATION

TWO PARK AVENUE, NEW YORK 16, N. Y. FACTORY: DANVILLE, PA.

Rocky's NOTES

Nathan C. Rockwood

Cautious Experts—Journalism—and Research!

WE KNOW OF A CONVERSATION among some people especially interested in cement and concrete research, during which some of our articles came in for comment. The conversation went something like this: "How can this guy Rockwood possibly be an expert on all these things?" Fortunately a friend present, of keen perception and understanding, gave the answer, probably more succinctly than we could have done. He said: "Rockwood is not an expert; he is a journalist. If he were an expert he would not be a journalist." That's a compliment! We know what a journalist is, but we have heard several definitions of "an expert."

Then, there are friends and well-wishers who say "a man who admittedly is not an expert has no business criticizing experts" (or more accurately the work of experts). Now with that we disagree, so long as we conceive our criticisms (if such they are considered) to be constructive; and we have reason to believe they have generally been so considered and, since research experts never criticize research, who is there to criticize it? To be sure, they differ among themselves as to interpretation of results, but they are apt to consider their work as a whole sacred so far as laymen are concerned.

"Old Timers" Viewpoint

On the other hand there are at least a few "old timers," mellowed by age perhaps, with a sense of humor, who have a philosophic viewpoint. They can review their own research efforts more or less objectively, and admit privately that in so far as answering specifically and finally some of the vital questions of what makes durable concrete, and why some concrete of the same materials is sometimes good and sometimes bad, research has not made as much progress as some people appear to believe.

At no time have we intended to belittle the contributions of our engineer-researcher friends to art and science in the manifold uses of cement and concrete. Society as a whole as well as this industry and this journal of the industry owe them an immense debt of appreciation and gratitude.

However, as research men civil and construction engineers have their limitations just as do journalists. Since we have paid our respects to engineers as research men elsewhere in this issue in an article on concrete research, we will not repeat here. We only wish to emphasize that there are two separate and distinct kinds of product research, each equally valuable and productive, but in different ways, and they should not be confused with each other. One is fundamental research in *pure science* with no other objective than to learn all the facts and workings of Nature's laws; the other is *practical* and aimed at finding out and correcting some of the faults in the quality and use of specific materials or in construction practices. Needless to say, engineers as designers and constructors, are admirably suited to do this second kind of research, but being mainly practitioners of *applied science*, are they necessarily conditioned intellectually, have they the time, and have they that innate natural curiosity or inquisitiveness about everything to do the other kind of research in pure science?

Why? Why? Why?

Perhaps our point of view is best illustrated by an example. Recently we visited a laboratory where more than the average amount and variety of research is being done on state highway materials. We visited not only with engineers but with experts in several specialized branches of science. We wanted to learn more about a theory that the kind and amount of porosity both in a coarse aggregate and in concrete is the most important consideration in determining their durability. We found that research in this direction has proceeded no farther than determination of the total porosity in a piece of coarse aggregate and the percentages of pores large enough to be seen through a microscope and of those too small to be seen. It had been determined to the satisfaction of all concerned that above a certain percentage of these smaller-sized pores resulted in an unsatisfactory aggregate when used in pavement construction as ordinarily practiced.

We wanted to know *why* such material made poor concrete. The answer was, because in all the pavements where these particular aggregates had been used, there was extensive cracking and disintegration. Freezing and thawing tests of laboratory specimens had confirmed the findings. But, we said, that does not answer our question, *why* did the concrete disintegrate merely because these particular aggregates were used? That of course wasn't known, and the engineers in charge were just too darn busy trying to establish ways of distinguishing good aggregate from bad to have time or funds to engage in this kind of research.

Research by Engineers

The engineer's kind of research leads to many independent tests and investigations, and engineers who by education and training try to deal exclusively in facts make guarded conclusions, always qualified, however, by a statement of conditions and circumstances, and usually accompanied by a warning that broader interpretations are not justified. Experts are naturally cautious and jealous of their professional reputations; they are usually careful to give other experts as authorities for many of their conclusions on this or that point, so much so that an inquisitive reader sometimes wonders if they have any really definite opinions of their own. It sometimes seems they write more to complement and supplement the conclusions of other experts, than to project any convictions of their own.

Constructive Criticism

In all seriousness, though, let us emphasize again, that we are trying to be helpful and constructive, because that is our conception of good industrial journalism. We desire to stimulate and provoke thought and research in hopes that questions we raise, and the theories we promote, will be answered eventually, yes or no. We would be as delighted to be proved wrong as right, because either way will show that some qualified expert has read our stuff and was at least sufficiently impressed to pursue our slant on the problem. Human nature is such that people often work harder to prove some one else wrong—and, in this instance, perhaps that the promoter of the idea was an ignoramus—than to support an idea or theory they don't want to believe. Hence, if some of these theories and conclusions are considered too positively worded for any one but a top expert to make, please bear in mind that statements made with too many qualifications seldom arouse the necessary interest—or shall we say ire—to produce results, and this applies to the statements of experts to one another, as well as here. In other words, progress in any research can become *too cautious*. The greatest discoveries in pure science often have been made by scientists who were first reviled for their "crazy" theories by their professional contemporaries.

THE EUCLID WAY

to

LOWER HAULING COSTS

Designed and built to move big loads of rock and heavy excavation, Rear-Dump "Eucs" are cutting haulage costs at quarry and open pit mining operations in all parts of the world.

Here's one example: seven Rear-Dump "Eucs" of 15-ton capacity replaced an industrial rail system at a quarry of the Consumers Company at McCook, Illinois. Hauling costs have been cut 40 per cent.

Two shovels of 3½ yd. capacity load the well-blasted stone into Euclids for a haul of 3,070 feet to the plant. Maximum grade on the loaded haul is 9.5%. During an eight-hour shift, the Euclids make 340 trips, hauling 5,440 tons. Production of lime and crushed stone for agricultural and industrial use averages from 600 to 700 tons per hour.

Your Euclid Distributor will be glad to show you the Euclid way to lower hauling costs on your quarry or open pit jobs. If you prefer, write direct for information on the complete line of Euclid equipment for moving earth, rock, coal, and ore.

The EUCLID ROAD MACHINERY Co., Cleveland 17, Ohio

EUCLIDS *Move the Earth*

LABOR RELATIONS TRENDS

Behind the General Motors Contract

By NATHAN C. ROCKWOOD

THE CONTRACT between the General Motors Corporation and the U. A. W.-C.I.O. is probably the most important management-union-labor deal in several years. It was received by other employers with mixed emotions. Some were frank to state it was inflationary; some apparently *did not* like it because union labor *did* like it. They thought union leaders were getting away with more than they were entitled to. In a speech before the National Press Club in Washington, D. C., June 8, Charles E. Wilson, president of General Motors, explained the corporation's philosophy in making this contract, which all employers ought to read in full, but probably few will. Consequently, we shall attempt a brief resumé.

The most unusual feature of the contract is probably its five-year term, without any reopening provision. The previous contract was for two years. It retained the so-called cost-of-living "escalator" clause, whereby hourly wage rates are adjusted periodically to the Bureau of Labor Statistics cost-of-living index. In addition, it assures labor an "improvement factor" in wage rates, which recognizes the lower costs anticipated from improved methods and mechanical developments. There is a new kind of union security provision, designed to curtail union abuse of its power to prevent employment of members, or exmembers, who disagree. It provides a pension plan not so much different from that of the U. S. Steel Corporation.

President Wilson's Story

Behind this agreement, President Wilson said, were years of building up good, workable relationships with unions, based on reason and experience. He stated it: "The present agreement is, therefore, based upon experience, logic and principles rather than on pressure, propaganda and force. The principles are important and, we believe, can be applied generally." These principles were described in some detail in his speech. Briefly, they are: (1) That it is logical, fair and reasonable to maintain the purchasing power of an hour's work in terms of goods and services the employe must purchase in his daily living; (2) all Americans look forward to improving their condition, and the workman along with everyone else is entitled to share in the advancing prosperity; (3) the nation's prosperity advances through use of science and technology, resulting in better tools, methods and organization; (4) producing more with the same amount of human effort is a sound economic and social objective that discards some union's false philosophy of made-work, featherbedding, etc.; (5) insecurity worries people, and it is reasonable for the employer to remove such worry as is possible; (6) cooperation and peace in labor relations is best for all concerned.

Cost-of-Living Formula

President Wilson explained the reason for the cost-of-living formula in these words: "This provision protects our employes against inflation, but in itself is neither inflationary or deflationary; it follows what other pressures have forced on the national economy. Inflation depends upon money supply, the fiscal policies of our federal government, credit policies of banks and finance companies, tariffs and subsidies, lack of production created by wars, strikes, export policies or partial crop failures, none of which employes or corporation have much to say about."

The annual increment or "improvement factor" of 4c per hour, for each of the next five years, Mr. Wilson said, is based on a 2½ percent annual increase in the average wage and represents a little less than the nation's manufacturers as a whole have been able to achieve in average annual cost reduction through improved facilities and methods each year during the past 50 years. The General Motors' contract therefore merely projects the same percentage saving during the coming five years. Mr. Wilson said on this point: "Of course, we hope to do better ourselves and, in addition to raising real wages, continue our policy of improving our products and reducing our prices. We are certain that small businesses have just as great an opportunity to improve their efficiency and their operations and take advantage of modern knowledge and technology as we have. In many instances they have greater opportunities because they are not quite so far down the road."

The most important part of this agreement, is, as Mr. Wilson points out, the recognition by labor that advance in living standards is accomplished only by greater production at no greater unit cost. In his own words: "The benefits of technology in raising the standard of living of a country can be dissipated through strikes, work restrictions, featherbedding, absenteeism, and an artificially short work week. Without a clear understanding regarding this matter we would not have had the courage to promise in advance a yearly increase in real wages. Both parties completely accept the principle of progress including the use of machines, mechanized power and better organization, better working conditions and better arrangement of the work in order not to waste human effort. If the people of our country really understand this principle and stick to it, and are willing to work for the things they would like to have, just as they have been willing to do in the past, I have no worries about our country being able to stand the cost of pensions, insurance and high wages."

Union Security Provision

The essential features of the contract clauses covering "union security" provide (1) that any employe who is already a member of the union, as a condition of continued employment, must maintain his membership to the extent of paying his dues and assessments; he may, if he chooses, sign an authorization for a check-off; (2) any employe who is not a member of the union shall not be required to become a member as a condition of continued employment; but if he joins the union during the life of the contract, he must keep up his membership; (3) any employe hired after the effective date of the contract must become a union member upon acquiring seniority, and must remain a member for one year; at the end of a year, on due notice, he can resign from the union if he so wishes.

In explaining these provisions, Mr. Wilson said: "They should enable the union to carry out more effectively its responsibilities under the agreement while at the same time they provide job protection to the minority of our employes who for reasons of their own do not desire membership in the union. In certain labor circles there is considerable discussion over these provisions of our contract as to whether we did or did not grant a union shop. As a practical matter, any employer, in whose plants or offices unions have bargaining rights, has a union shop—not by the specific definition of the term, but in the broad sense that he must deal with the union in regard to wages, hours and other working conditions, including pensions and insurance programs. The important thing is to have the union security provisions worked out in such a way that they reasonably protect individuals against union purges or abuse of unionism. In other words, a workman's living cannot be taken away from him because he has gotten into a political tangle with his union."

Contract Making in General

"We put a great deal of value as a practical matter on the contract language of the agreement," said Mr. Wilson. Many of these have stood the test of ten years of interpretation fair to all concerned. In other words, they are carefully drawn to be clear and understandable. He said: "I would recommend that those who are interested, or who have the practical problem in their own businesses of working out agree-

(Continued on page 121)

✓ in Dredging — it's the solids pumped — that counts!

Above: E. T. Slider Co., Louisville, Ky., Ohio River dredge No. 5 equipped with 15"—75' heavy duty "Swintek." Double side braced for heavy river bar dredging conditions. This highly sucessful producer has used "Swinteks" for nearly 20 years.

Eagle "Swintek" Dredging Ladders *get* the Solids!

YOU can't sell water—it costs money to pump it—it's the sand and gravel intake that counts. Put an Eagle "Swintek" unit on your dredge and watch the ratio of solids to water zoom up! The digging chain passes over an arcuate track at the end of the dredge ladder, hugging the intake nozzle, shielding it against boulders and logs—prevents clogging and abuse to pumps. The cutters chop loose impacted aggregate and get it into suspension so the pump can "do its stuff." Clay and silt are churned away from pumping zone. An even flow of material to shore plant is assured.

It is not uncommon to increase dredge output 400% or more. Many dredging operations that were in the red have been put into the profit column for keeps by installation of a "Swintek." CHALLENGE that statement—we would like to prove it to you. See an installation—send for Catalog 745.

At Left: Special lightweight 60' Eagle ladder increased output 400% for Penn Jersey Sand & Gravel Co., Bridgeport, N. J.—average over 150-tons per hour, using 6" pump.

By installing an 8"-45' Heavy Duty Eagle "Swintek," Bowersock Sand Co., Lawrence Kan., doubled production, cut through clay strata to reach virgin sand, keep rocks out of line. "Sorry they did not buy it sooner."

SINCE 1872 Progress...Service

Sand and Gravel Equipment

"SWINTEK" DREDGE LADDERS — SCREW WASHERS
LOG WASHERS — DEHYDRATORS — SAND TANKS
CLASSIFIERS

EAGLE IRON WORKS

1137 Holcomb Ave. • Des Moines, Iowa

the *Personal Side* of the news

On N.C.M.A. Staff

CHARLES J. FRENCH, JR., has joined the staff of the National Concrete Masonry Association, Chicago, Ill., as assistant engineer. Mr. French is a

Charles J. French, Jr.

graduate of Colorado College with a B.S. degree in civil engineering. He also studied at Purdue University and Morgan Park Junior College. Among the courses taken during his training were surveying, plain concrete, reinforced concrete design, elementary structures, steel design, indeterminate structures, sanitary engineering and highway engineering.

Consultants

GEORGE J. SCHAEFER, JR., Walter J. Gabriel, and William W. Schwendinger have announced the formation of Mine & Quarry Services, Inc., St. Louis, Mo., for geological and geophysical services to the mineral and engineering industries.

Association President

WALTER N. LAWSON, assistant treasurer and credit manager of the Medusa Portland Cement Co., Cleveland, Ohio, has been elected president of the Cleveland Association of Credit Men.

Elected President

IRVIN L. CLYMER, president of the Michigan Limestone and Chemical Co., Rogers City, Mich., and the Bradley Transportation Co., has also been elected president of the Pittsburgh Limestone Corp., Pittsburgh, Penn., to succeed Arthur W. Worthington, who has retired. Ralph E. Larry, vice-president, has also retired. Mr. Clymer has been president of both companies since 1939. He is a native of Mt. Cory, Ohio, and a graduate of Purdue University. He was associated with the Robins Conveying Belt Co. as a draftsman and engineer before joining the Michigan Limestone and Chemical Co. and the Bradley Transportation Co. in 1926 as chief engineer. He was elected vice-president of both companies in 1938 and president in 1939.

Mr. Worthington is a native of Steubenville, Ohio, and graduated from Rose Polytechnic Institute in 1906. He was engineer in charge of construction for the Pennsylvania Railroad before joining the Koppers Co. in 1916 as engineer in charge of by-product coke plant construction. After service in World War I as a captain of engineers in France, he joined the Pittsburgh Limestone Corp., in 1920, as assistant to the general manager. He became general manager in 1930, vice-president and general manager in 1932, and president in 1940.

Mr. Larry was born in Providence, R. I. He completed his engineering education at Lincoln Memorial University and Brown University in 1905 and served in various capacities in coal, iron ore and limestone mining prior to joining the Pittsburgh Limestone Corp. in 1921. He was assistant to the president for several years,

Irvin L. Clymer

after serving successively as plant superintendent, supervisor of operations, engineering assistant to the general manager and supervisor of industrial relations. He was elected vice-president in 1947.

Sales Engineer

C. E. LOVEWELL, formerly chief engineer and sales manager for the Carney Co., Mankato, Minn., has joined the Pioneer Engineering Works, Inc., Minneapolis, Minn., as sales engineer. At the Carney Co. Mr. Lovewell supervised product development, plant

C. E. Lovewell

design, equipment installation and service engineer, as well as sales and sales promotion. From 1936 to 1945 he was engaged in sales and sales promotion for the Louisville Cement Co. in the Washington, D. C., and Louisville, Ky., areas, where his research and practical approach to problems involving concrete led to new specifications in the field. Much of his time was spent with government engineers developing quality cements for camps, airfields and postwar dams. He has served with the U. S. Bureau of Air Commerce (now C.A.A.), the Brick Manufacturers Association and the U. S. Bureau of Standards. A civil engineering graduate of the University of Wisconsin, Mr. Lovewell has held memberships in the Minnesota Association of Professional Engineers; The Committee for Development of Natural Resources of Minnesota; Highway Research Board, Washington, D. C.; and on Committees C-1 and C-7 of the American Society for Testing Materials.

On Board of Directors

ROBERT C. BOURNE, president of Tomkins Brothers, Newark, N. J., has been elected a member of the board of directors of The Kelley Island Lime and Transport Co., Cleveland, Ohio, to succeed William G. Mather, who has been a director for nearly 40 years and declined renomination.

Honorary Members

PHAON H. BATES, retired chief of the Clay and Silicate Products Division of the National Bureau of Standards, Washington, D. C., and WILSON C. HANNA, chief chemist and chemical engineer of the California Portland Cement Co., Colton, Calif., have been awarded Certificates of Honorary Membership in the American Society for Testing Materials. These awards were made in recognition of their technical work in engineering materials and for especially meritorious service to the organization over many years. In his early career Mr. Bates was associated with the society's first president, Charles B. Dudley of the Pennsylvania Railroad, and was for many years in charge of the Pittsburgh branch of the National Bureau of Standards. He served the A.S.T.M. in many important capacities and was chairman of Committee C-1 on Cement for almost 20 years. He was president of the society from 1944-1945. Mr. Hanna is the oldest member in point of service in the A.S.T.M. in the West and is the first Honorary Member from that section. He has been associated with the California Portland Cement Co. since 1903. His work has involved cement, lime, concrete and mortars, and he did important pioneering work on the chemical analysis of cement. A former member of the A.S.T.M. board of directors, he received the 1948 Sanford E. Thompson Award for his outstanding paper on chemical reactions of aggregates.

Joins Sales Staff

GEORGE COPE CARDEN has joined the sales staff of the Signal Mountain division, Chattanooga, Tenn., of the General Portland Cement Co., Chicago, Ill. Mr. Carden graduated this year from the University of Chattanooga. Before entering the university in 1946 he served three years in the Army, 12 months of which were spent in the Pacific area.

Joins Concrete Pipe Firm

BRENDAN P. O'HARA, formerly associated with the Universal Atlas Cement Co., New York, N. Y., has been appointed sales engineer in the New York office of the Universal Concrete Pipe Co., Columbus, Ohio.

Vice-President Retires

A. D. WARNER, JR., vice-president of finance for Warner Co., Philadelphia, Penn., has retired after 50 years of service with the company. He will continue to serve as a director and member of the executive committee. Mr. Warner joined the company in 1900, shortly after graduating from Cornell University. In 1902 he was elected treasurer and has been handling all financial details of the firm since that time, including the program of improvement in 1936 which involved the spending of millions of dollars. In 1945 the capital structure of the company was simplified under his supervision. Since his retirement as treasurer in 1946, Mr. and Mrs. Warner have been traveling extensively, and he has been able to devote more time to his hobbies and personal activities.

Returns from Iran

CARL J. LOFSTEDT, formerly general operating manager for Pennsylvania-Dixie Cement Corp., New York, N. Y., recently returned from Iran and a tour of Western Europe. While in Iran, Mr. Lofstedt completed the outline of an expansion program for that nation's cement industry.

Association Directors

R. F. HIGGINS, Hazard Concrete Products Co., San Diego, Calif., and Ira C. Lackey, Curtiss-Merrill Products Co., Montebello, Calif., have been appointed directors of the Concrete Masonry Manufacturers Association, Los Angeles, Calif., for the balance of the 1950 term.

Traffic Manager

JAY BARBEAU has been appointed traffic manager of Kaiser Gypsum, Oakland, Calif. He was formerly San Francisco traffic representative of the New York, Chicago and St. Louis Railroad.

Honor Speed Family

SPECIAL RECOGNITION was given recently to the Speed family at the dedication of the new $300,000 mechanical engineering building, Frederic M. Sackett Memorial Hall, at the University of Louisville's Speed Scientific School, in commemoration of the school's 25th anniversary. The building was named for the late U. S. Ambassador to Germany under President Hoover. William S. Speed, chairman of the board of the Louisville Cement Co., Louisville, Ky., and his sister, the late Mrs. Olive Speed Sackett, gave the original grant for the school in memory of their father, James Breckenridge Speed. Later gifts were donated by them for construction of the main Speed School building and Sackett Hall. Mr. William S. Speed was born in Louisville, Ky., in 1873, and graduated from Rose Polytechnic Institute where he studied engineering. He has been associated with the cement company since 1895 and has served as director, vice-president, general manager, and president. He has been chairman of the board since 1939.

Assistant to Secretary

EDWARD J. BRUNENKANT, JR., has been named assistant to Robert M. Koch, executive secretary of the National Agricultural Limestone Association, Washington, D. C. Mr. Brunenkant, who has been field editor for *Pit and Quarry* for the past three years, attended the University of Michigan where he majored in engineering, after which he spent three and a half years in the Military Intelligence Service.

President Truman being welcomed at the opening session of the President's Conference on Industrial Safety. Left to right: Maurice J. Tobin, secretary of labor, who is general chairman of the Conference; President Truman; William L. Connolly, director of the Bureau of Labor Standards and chairman of the Coordinating Committee of the Conference; Vincent P. Ahearn, executive secretary of the National Sand and Gravel Association, who is executive director of the Conference. At the conclusion of the Conference Mr. Ahearn was presented with a special Award of Merit by Secretary of Labor Maurice J. Tobin for his valuable contribution to the success of the Safety Conference

Visits Europe and Africa

HARLOWE HARDINGE, president of the Hardinge Co., Inc., York, Penn., recently returned from a 25,000-mile business trip through Europe and Africa, during which he visited England, France, Belgium, Germany, Belgian Congo, Northern Rhodesia, and South Africa. Following are some of the comments he has made on conditions in the countries which he visited:

England: "The British 'austerity' program is creating lack of incentive for British workers, because they are unable to purchase anything but the bare necessities of life, regardless of their income. Lack of incentive means poor productive effort, which means higher manufacturing costs, which means that England has priced itself out of the market on many manufactured items. Devaluation of the pound has helped, but their prices are still higher than in other European countries. However, their industrial machinery business is very good, in some cases the backlog ranges from 2 to 4 years.

Belgium: "An entirely different spirit prevails in Belgium. They guaranteed their currency at the close of the war and pulled out of their financial difficulties sooner than any other European country. Food and gasoline are plentiful and business is good. Belgium industrial prices, at least, are considerably lower than those of England, on a par with France, but higher than German prices. There is an air of purposeful activity in Belgium and the Continent that does not seem to be so prevalent in England.

Germany: "I find the Germans extremely meticulous about their business agreements, but fair and reasonable. Once they have made an agreement, my experience has been that they stick to it without quibbling. The German attitude toward the occupation forces is about the same as that toward any group in power in Germany—cooperative. The bulk of the German people are followers, not leaders. There are a few German individuals with arrogant militaristic tendencies who have to be forcefully reminded from time to time that the occupation authorities mean business, but most of the Germans take orders well. There is no question about their feeling for the Russians. They hate and fear them. Russia is doing its best to spread anti-American propaganda throughout Western Germany.

Belgian Congo: "A very clean place—very little disease in the cultivated areas. The medical authorities have very strict control, and malaria, the dread killer of earlier days is very scarce now. American automobiles are everywhere, as well as American movies and domestic equipment, such as refrigerators, stoves, washing machines, etc. Most of the textile materials come from Europe, clothes, etc. A mining company with far-flung interests which I visited there is said to be the world's leading producer of cobalt, also one of the major producers of copper and uranium. They employ many skilled native workers in machine shops, foundries, offices, etc.—appear to be highly progressive and up-to-date in their operating methods.

Northern Rhodesia: "Northern Rhodesia contains the so-called 'copper belt' which is one of the major producers of copper in the world today, and may some day be the greatest.

South Africa: "Gold and diamond mining are the most important businesses here. Devaluation of the British pound has increased the value of gold, and business is booming. A new gold lode was discovered recently in the New Orange Free State which is just now being developed. This is a land of progress and opportunity. Industry outside of mining is expanding rapidly. Living standards are high for the white population, but *cost* of living is lower than ours, except for imported items. British automobiles compete with American-made cars here only because of the British monetary devaluation. Severe restrictions have also been imposed on the importation of American cars and some other commodities due to the exchange situation. Citizens are loyal to the British King, but generally unsympathetic to the British government. They are proud of their self-sufficiency, their own manufacturing facilities are excellent, and they resent too much foreign intrusion."

OBITUARIES

MAX LEVERETT CAUDILL, owner of the St. Paul Sand and Gravel Co., St. Paul, Neb., was accidentally drowned on June 23 when he fell into a sand pit. He was trying to clear a gravel pumper when he lost his balance. Firemen administered artificial respiration for about an hour but were unable to revive him. Mr. Caudill was 38 years old.

GEN. THOMAS STEVENS HAMMOND, chairman of the board of Whiting Corp., Harvey, Ill., passed away at his home in Chicago, Ill., on June 15. Mr. Hammond joined the corporation in 1907 as assistant purchasing agent and subsequently become president and general manager. He had been chairman of the board for the past several years. Gen. Hammond's military career began as a private in the Illinois National Guard in 1915 and included service in both World Wars. He retired in 1940 as major general. In January, 1942, he entered the services of the Chicago (Army) Ordnance District, War Department, as production advisor, then chief of production, deputy district chief and in August, 1942, became district chief. He retired in 1946.

JOSEPH ANTHONY KRUGLER, vice-president of Taylor Wharton Iron and Steel Co., High Bridge, N. J., died June 19 at his home in Easton, Penn., after an illness of about two months. He was 50 years old. Mr. Krugler was born in Philadelphia and graduated from Rensselaer Polytechnic Institute in 1923. He joined Taylor-Wharton the same year and was assigned to the Scranton office, later transferring to New York City. In 1936 he went to Easton as general sales manager, and in 1942 was named vice-president in charge of sales. During World War II, Mr. Krugler served on committees of the War Production Board and the Office of Price Administration. He was affiliated with the National Sand and Gravel Association, National Crushed Stone Association, Compressed Gas Association, and the Steel Founders Society of America. He served as chairman of the Manganese Track Society and the Manganese Steel Founders Society.

HENRY H. KRANZ, president of the Municipal Division of the American Road Builders' Association, Washington, D. C., and city engineer for Cincinnati, Ohio, passed away suddenly on June 10, a short time after he had completed a meeting of engineers of the Mahon Steel Co. in Cincinnati. He was 63 years old. A native of Cincinnati, and a graduate of grade and high schools there, Mr. Kranz received his civil engineering training and degree from the College of Engineering, University of Cincinnati. He was a captain in the Army Engineers in the American Expeditionary Force in France from 1917 through 1919, then returned to private industry before joining the City of Cincinnati in 1926, serving as superintendent of highway maintenance, engineer of highways and then as city engineer. He served as host to the 47th annual meeting of A.R.B.A. when it was held in Cincinnati last March.

JOHN REYNOLDS MORRON, president of the former Atlas Portland Cement Co., from 1910 to 1929, when he retired, passed away on June 27 at Littleton, N. H. He was 83 years old.

WILLIAM ALLEN SMITH, founder of the Uvalde Rock Asphalt Co., San Antonio, Texas, died June 24 after an illness of three months. He was 83 years of age. Mr. Smith was also one of the founders of the Sabine Tram Lumber Co.

JAMES A. MARTIN, a partner and former president of the Plaza Sand and Stone Corp., Yonkers, N. Y., died June 24 at the age of 57. Edward J. Murray, Democratic city chairman, is now president of the firm.

Give your engines more "PUSH"

AND reduce operating costs by lubricating with TEXACO URSA OIL X**

Keep your tractor and truck engines *clean* and you'll have full power when you need it . . . maintenance costs and fuel consumption will both be lower. For heavy-duty gasoline and Diesel engines, the lubricant to use is *Texaco Ursa Oil X***. It's detergent, dispersive, dependable in even the severest service.

*Texaco Ursa Oil X*** has oxidation resistance to spare. Thus, engines don't get "lacquered up," rings stay free and valves act the way they're supposed to. You get all the power your engines are designed to deliver. *Texaco Ursa Oil X*** stands up under heat and pressures . . . protects parts against wear . . . protects bearings against corrosion.

3 Other Maintenance Cost Reductions

Chassis bearings will get extra hundreds of miles of protection, chassis parts will last far longer, when you lubricate with *Texaco Marfak*.

Wheel bearing replacements will be far fewer when you lubricate with *Texaco Marfak Heavy Duty*. It seals out dirt and moisture, requires no seasonal change.

Crawler track mechanisms run better, last longer, protected with *Texaco Track Roll Lubricant*. It gives long-lasting protection against water, dirt and wear.

Follow the Texaco Simplified Lubrication Plan and save maintenance costs all along the line. A Texaco Lubrication Engineer will gladly give you full details. Just call the nearest of the more than 2,000 Texaco Wholesale Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO Lubricants and Fuels

INDUSTRY *News*

National Gypsum Co.'s Safety Record

NATIONAL GYPSUM CO. plants throughout the country so far this year have reported a 27 percent reduction in the number of all injuries and have been cited by trade associations and the National Safety Council for outstanding work in accident prevention, F. A. Manske, the company's general production manager, has announced. The firm's Baltimore plant received the highest award in class A of the Gypsum Association safety contest. In this competition, the plant topped a list which included 50 out of the 54 largest gypsum mills in the country.

Other National Gypsum plants to be recognized so far this year for limiting the number of lost-time accidents include the lime plants at Bellefonte and York, Penn. The Bellefonte plant was cited by the National Lime Association as one of the industry's leading plants in accident prevention, while the York plant was rated in fourth place in this competition. Both plants completed last year without a single lost-time accident.

The limestone mine at Bellefonte also received a top award presented in the 1949 National Safety Competition sponsored by the magazine *Explosives Engineer*.

Ideal Cement Expansion Program

IDEAL CEMENT CO., Denver, Colo., will begin an immediate expansion program of the Ada, Okla., cement plant costing approximately $1,000,000, according to M. O. Matthews, vice-president and general manager of the Southern Division. A longer-time modernization and expansion program costing that much more also is planned. Contracts call for a new kiln, grinding unit, cooler and all necessary auxiliary equipment to increase the capacity of the plant from 1,400,000 bbl. of cement per year to 2,250,000 per year. The new equipment is to be in place and ready to operate by October 1. In addition, a new quarry is to be opened at Laurence.

Jap Cement for Alaska?

REPORTS THAT the Defense Department will use Japanese cement in Alaskan military construction have stirred Pacific Northwest manufacturers. Olympic Portland Cement Co., which shipped 125,000 bbl. to Alaska last year, has closed its Bellingham, Wash., plant because of failure to receive such orders this year, it was stated. Bids were to be opened at Anchorage May 10 on 80,000 bbl. but conditions on these bids assured the Japanese of the business, the Seattle sources said. John G. Forrest, Seattle representative of the United Cement, Lime and Gypsum Workers, charged Army discrimination in favor of Jap cement. The Anchorage bid call provided that foreign sources would be exempt from certain conditions such as the 40-hr. week, no convict labor and use of American raw materials.

A persuasive factor in favor of the Japanese product is a shipping charge reported to be only $2.50 per ton from Japan to Alaska. It costs $17 per ton from Seattle to Alaska. The lower rate is said to be motivated by the need for ballast for ships returning from Japan.

Installs New Mineral Wool Cupola

SEALTITE INSULATION MANUFACTURING CORP., Waukesha, Wis., has installed at its Merton, Wis., plant what it claims is the largest and one of the most efficient steam-generating cupolas in the world for the production of mineral wool. The molten rock is blown into fibers by steam.

The firm is now introducing the Seal Foil batt, a mineral wool sheet with

Installing new cupola for manufacturing rock wool

an aluminum foil backing. The new cupola will be used to furnish the mineral wool for this purpose, and will have a capacity of 48 carloads of batts a week, the company states.

Basis Reached for Lime Pact

EMPLOYES OF NATIONAL GYPSUM CO.'s Luckey, Ohio, operation have accepted a company offer of five cents per hour wage increase. As a result a break in a stalemate and establishment of a pattern which may result in settlement of issues between management and labor in the northwest Ohio lime industry is foreseen. The offer was accepted during a meeting of workers at the plant. The unit is part of the United Stone and Allied Products Union of America which has affiliated locals in The Kelley Island Lime & Transport Co., National Mortar & Supply Co., Gibsonburg Lime Products Co. and Ohio Hydrate Co. All of these companies have had similar contracts which have been under negotiation for new agreements for the past several months.

In addition to the hourly increase, National Gypsum Co. workers will receive time and one-half for Sunday work and double time for holidays. The union agreed, however, not to ask for pension plans the next five years or additional insurance benefits for the next two years.

Safety Program

FISCHER LIME & CEMENT CO., Memphis, Tenn., uses "Safety Is No Accident" as a slogan among employes. During the past years Fischer Lime & Cement Co. and its subsidiary companies, Fischer Steel Corp. and Concrete Products Corp., have stressed the fact that "Safety is Courtesy and Courtesy is Safety," and find it pays big dividends. Although the average Fischer truck driver drives approximately 15,000 miles per year, only one minor time-loss accident was reported in a total of 154 days this year. Under the direction of Cecil Heyman, safety director, and Dell Roberts, safety chairman, safety meetings are held every three weeks at which time open discussions take place wherein employes may point out any safety hazards encountered on their jobs. Then corrective measures are recommended.

Cement Plant Expansion

VOLUNTEER PORTLAND CEMENT CO., near Knoxville, Tenn., has announced a $1,000,000 expansion program to be completed by fall. The company expects to increase its production from 1,400,000 bbl. of standard and masonry cement to 2,000,000 bbl. The plant has a 150,000 bbl. storage capacity.

Gypsum Antitrust Charges Upheld

THE SUPREME COURT, by a 7-0 vote, has upheld government charges that U. S. Gypsum Co., Chicago, Ill., and six other companies have violated the Sherman Antitrust Act. The court affirmed a decree issued by a special three-judge District Court in Washington which declares that the companies have "acted in restraint of trade" and have "monopolized trade and commerce in the gypsum board industry" in the eastern United States. The court also barred the companies from "enforcing in any manner whatsoever the provisions of current license agreements fixing, maintaining or stabilizing prices of gypsum board."

Other defendant companies are National Gypsum Co., Certain-teed Products Corp., Celotex Corp., Ebsary Gypsum Co., Inc., Newark Plaster Co., and Texas Cement Plaster Co.

Observes Silver Anniversary

LONE STAR CEMENT CORP.'S Greencastle, Ind., plant recently observed its silver anniversary. At a dinner attended by over 300 employes, watches were awarded to 24 men who have been with the company for the duration of the Lone Star operation there. J. G. West, vice-president of the Indiana Division of the company, presented the awards and inducted the new members into the "Lone Star 25-year Service Club."

Plan $5,000,000 Cement Plant

CEMENT CORP. OF AMERICA, Ojai, Calif., has announced plans to construct a $5,000,000 cement plant on its property in the Ojai valley. An ultimate capacity of 5000 bbl. per day is planned. C. A. Low and Thomas A. Neale, owners of the property, at a recent hearing on the matter of erecting a plant, stated that they would use the wet process for economical reasons as well as to keep dust down. There had been some objection to the plant by the citizens of Ojai because of the dust problem.

Roofing Granules Plant

WENDELL MINERAL PRODUCTS LTD., Montreal, Canada, has announced plans to construct a new plant at Landrienne Station, Northwestern Quebec, for large scale production of granules for roofing shingles and wall siding materials. This plant, according to J. M. LaFon, vice-president, is to be erected at a cost of $150,000 and is expected to meet most of the Canadian requirement. At the present time, approximately 70 percent of the requirement is imported from the U. S.

The "Wendelite" granules consist of small broken particles of volcanic rock, artificially colored for decorative purposes. The granules are used primarily as a protective coating for asphalt shingles and are highly resistant to fire.

Mill for Processing Feldspar and Potash

WESTERN FELDSPAR CO., Denver, Colo., is erecting a mill for the processing of feldspar and soda potash, near its plant in Salida. Valuation of the mill, upon completion, has been estimated at close to $100,000. A stockpile of about 30,000 tons of material already is on hand at the mill, awaiting the processing machinery. For the past two years, the company had been shipping the soda potash into Denver for processing.

Buys Stone Quarry

THE LATROBE CONSTRUCTION CO., Latrobe, Penn., has purchased a stone quarry near Longbridge, Penn., from Booth & Flinn Co., Pittsburgh contractors. The Latrobe company formerly leased the 588-acre tract and quarry from the Pittsburgh firm.

Coming Conventions

September 1, 1950—

A. I. M. E., Minerals Beneficiation Division, Fall Meeting, Hotel Utah, Salt Lake City, Utah

September 5-9, 1950—

National Chemical Exposition, The Coliseum, Chicago, Ill.

September 18-20, 1950—

National Lime Association, Operating Division, Nittany Lion Inn, State College, Penn.

September 25-27, 1950—

National Sand and Gravel Association, National Ready Mixed Concrete Association, Board of Directors Meeting, Sun Valley, Idaho.

October 16-20, 1950—

National Safety Congress and Exposition, Stevens, Congress and Morrison Hotels, Chicago, Ill.

Portland Cement Production

PORTLAND CEMENT PRODUCTION during April, 1950, according to the Bureau of Mines, was 18,088,000 bbl., an increase of 2 percent over the output for April, 1949. Mill shipments reached 18,375,000 bbl. during the month, 3 percent above the April, 1949, total, while stocks of 22,918,000 bbl. on April 30 were approximately the same as the April, 1949, totals. Production in 1950 for the January to April, 1950, period was 60,570,000 bbl. of cement contrasted to 62,132,000 bbl. for the same months of 1949. Shipments for these months were 52,356,000 in 1950 and 50,298,000 in 1949, an increase of 4 percent.

Clinker output in April, 1950, was 18,086,000 bbl., or 4 percent above the corresponding month of the previous year. Production in 1950 for the January to April period was 65,028,000 bbl. compared to 66,179,000 for that period in 1949.

Installs New Lime Kiln

LIMESTONE PRODUCTS CO., Cleburne, Tex., is installing a new rotary kiln as part of a $600,000 expansion program. The kiln will have a daily capacity of 150 tons of lime. Plans to install another kiln of the same size are being considered for execution in about a year. A. T. Lohmann, director of operations, said. The company hopes to be able to fill at least the greater part of its orders as a result of the new installation.

Cement Firm Reimbursed for Overcharges

OKLAHOMA PORTLAND CEMENT CO., Ada, Okla., will receive refunds because of overcharges made by two railroads. The Oklahoma City-Ada-Atoka railroad had overcharged the company $9398 and the O.C.A.A. and Frisco lines combined had overcharged $570, the commission found. The case involved 105,000,000 lb. of cement and the refund was based on a difference of one cent per 100 lb.

The railroads were directed to pay the money to the commission which will deduct 10 percent for handling and pay the remainder to the cement company.

Booklet Discusses Pension Problems

THE NATIONAL ASSOCIATION OF MANUFACTURERS, through a subcommittee of its Industrial Relations Committee, is preparing and will soon publish a discussion, prepared principally for the relatively small employer, entitled "Management Faces the Pension Problem." This should be of interest to many firms now faced with demands in collective bargaining for establishment of pension and welfare funds.

Geologists Organize New Professional Institute

COORDINATION, COOPERATION AND SERVICE are the objectives of the American Geological Institute recently established by the geological profession in the United States. Operating as an affiliate of the National Research Council, which is a nongovernment scientific organization endowed with private funds, the institute furnishes "central representation for the geological sciences in all matters which are of interest to the entire profession."

The institute is particularly interested in broadening the pertinent application of geological science to industrial needs, and if it is to be successful in this regard, must enjoy the cooperation of the mining and mineral industries.

The A.G.I. is made up of scientific societies rather than individual members. Its affairs are directed by a Board of Directors composed of two representatives from each of the member societies, which are: American Association of Petroleum Geologists, American Geophysical Union, American Institute of Mining and Metallurgical Engineers, Geological Society of America, Mineralogical Society of America, Paleontological Society, Seismological Society of America, Society of Economic Geologists, Society of Economic Paleontologists and Mineralogists, Society of Exploration Geophysicists, and Society of Vertebrate Paleontology.

In addition, non-profit organizations of a regional or local nature may join the institute as affiliates. This group can include professional or amateur groups, or local, state and regional non-profit organizations of operators, owners, and managers of mining, quarrying, oil-producing or other types of mineral operations, which are interested in the applications of geological science but are not primarily scientific in nature.

Full information about the institute and its activities are available from David M. Delo, executive director, American Geological Institute, 2101 Constitution Avenue, N. W., Washington 25, D. C.

Permanente Cement to Expand Facilities

PERMANENTE CEMENT CO. has announced an expansion program which will augment its distribution facilities and provide an additional 5,600,000 sacks of cement a year for the continuously growing western business and construction industry. The entire expansion program is expected to cost about $3,500,000, creating new jobs for additional plant personnel as well as construction workers.

The Permanente cement plant, located in the San Francisco Bay area near San Jose, will be increased 25 percent in capacity, according to Henry J. Kaiser. The expanded plant will produce 28,000,000 sacks of cement a year, or 7,000,000 bbl.

A fifth giant kiln and other major equipment and additions will be added to Permanente's Bay Area plant to increase its annual production by more than 1,400,000 bbl. (5,600,000 sacks). This new program represents Permanente's fourth major expansion in a decade.

The program also includes enlargement of facilities in Seattle, thereby carrying out expansion of Permanente Cement Co.'s established system of distribution plants which serve markets from northern California to the Pacific Northwest, Canada, Alaska and Hawaii. The expansions are scheduled for completion by February, 1951.

The way was cleared for Permanente Cement to proceed immediately on the project when the Santa Clara County Board of Supervisors approved the action of the County Planning Commission in granting a permit for the plant expansion.

Dolese Plans $1,000,000 Reconstruction Program

DOLESE BROS. CO., Oklahoma City, Okla., is beginning an expansion program at its Richards Spur crushing plant variously estimated at $1,000,000 and $2,000,000. Completion is expected by next spring at which time the operation is expected to be one of the largest in the Southwest.

When fire ruined the old plant in September, 1948, damage to machines and buildings neared $1,000,000. Since then, temporary equipment being used has been hard put to meet the old plant's 450 t.p.h. capacity. The new plant will be able to surpass this production.

Cement Firm Expands

IDAHO PORTLAND CEMENT CO., Spokane, Wash., has launched an expansion program which will double its output. E. A. Dufford, vice-president of the company, announced that additional equipment is being purchased for the Inkom plant and is expected to be in operation at the end of the year.

The company started operations in 1929 with one 200-ft. rotary kiln. It is now adding a second kiln which is 320 ft. in length. The company is now shipping about 160,000 sacks per month and will ship close to 2,000,000 this year. Anticipated shipments after enlargement are expected to be 4,000,000 sacks a year.

Quarry Reopens

LAWRIE CO., Milwaukee, Wis., subcontractor of Great Lakes Dredge & Dock Co., has resumed operations in the quarry at Redgranite, Wis. The big granite quarry had been idle since 1932 but has returned to work with an order for stone for a rubble breakwater in Lake Michigan off South Shore park in Milwaukee.

Stream Pollution Problem

A. H. SMITH SAND AND GRAVEL CO., Branchville, Md., has been ordered by Judge John B. Gray in the Circuit Court to take steps to stop pollution of Indian Creek. Judge Gray suggested several alternative actions the company might take and gave it 60 days to adopt one of them. He retained jurisdiction "in order to compel the construction, maintenance and operation of the alternative adopted and to determine whether or not such method effectually prevents the pollution of Indian Creek." He also reserved the right "to require the adoption of other or additional methods in the event the plan adopted fails to prevent the pollution of Indian Creek by Smith's washing operation."

Gypsum Production in 1950

DOMESTIC MINE PRODUCTION of 1,642,328 short tons of crude gypsum during the first quarter of 1950 was the greatest tonnage produced in any first quarter on record, the Bureau of Mines has reported in a *Mineral Industry Survey*. Imports of 414,398 short tons of crude gypsum were also a new record for the first quarter. Still another first quarter record was set when 1,573,862 short tons of calcined gypsum were produced.

Sales of gypsum for cement retarder were less than in the corresponding quarter of 1949. Declines were also reported in sales of agricultural gypsum and several of the minor products, but production of most of the important gypsum products increased and several new records were established, according to the survey report.

Wins Safety Award

SOUTHWESTERN PORTLAND CEMENT CO., Los Angeles, Calif., had a safety trophy awarded to its Osborne, Ohio, plant by C. D. Franks, vice-president for promotion of the Portland Cement Association. The plant operated during 1949 without a lost-time accident. A safety rally was held and the company's new Powell Park dedicated on the day the safety award was presented.

Pavement Yardage

AWARDS OF CONCRETE PAVEMENT for the month of May and for the first five months of 1950 have been announced by the Portland Cement Association as follows:

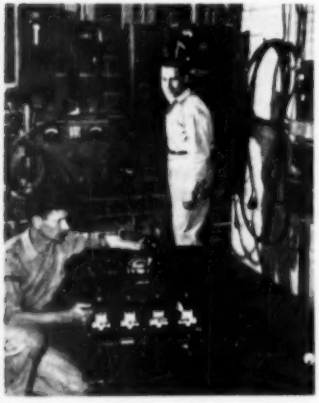
	Square Yards Awarded During May 1950	Square Yards Awarded During First Five Months 1950
Roads	3,417,288	11,588,391
Streets & Alleys	3,176,549	10,298,809
Airports	460,493	1,327,516
Totals	7,094,337	23,214,797

HINTS and HELPS

PROFIT-MAKING IDEAS DEVELOPED BY OPERATING MEN

Testing Equipment

HEAVY ELECTRICAL EQUIPMENT in the form of welding generators, transformers, voltage regulators and motor generators require rugged testing equipment of ample size to perform running tests for recommended periods. The apparatus illustrated is compactly located in a corner of the repair shop adjacent to the electrically-heated oven where all equipment brought in for repairs is thoroughly dried before being dipped or sprayed with insulating varnish and given a second heat treatment to bake the coating. Voltages supplied the test corner are 3-phase 115-volt a.c., 220-volt 3-phase a.c., 440-volt 3-phase a.c.



Portion of electrical testing section in typical heavy equipment repair shop

and 120-volt d.c. The large 440-volt switch in the corner is the main circuit breaker. Note that all the apparatus visible is grounded through a ground wire that skirts the wall on a level with the standing man's left hand. The floor is covered with a heavy layer of Neoprene oil-resistant matting for the protection of the workmen, and each test lead is provided with rubber sleeves to cover the spring clip.

Strengthening Conveyor Brake Assembly

LONG INCLINED conveyor belts usually are designed and installed with some kind of head brake mechanism so that if the power fails, or the loaded belt should stop for any reason, the belt will be prevented from reversing its direction. Few designers appreciate the strain on the head mechanism once a loaded inclined belt starts to reverse itself.

One plant had a brake mechanism on one of the main long inclined belts with bearings for the head pulley of the type shown in Fig. 1. The bolts holding the cap of the bearings did not

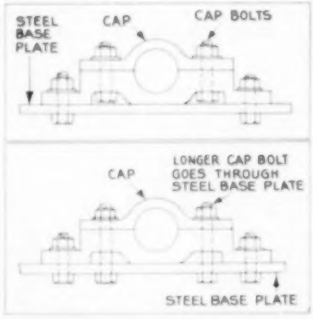


Fig. 1 (top): Former method of bolting bearing cap to main casting. Fig. 2: By having the cap bolts go through the entire casting and base assembly, there is now sufficient strength to withstand conveyor braking

go through the bearing casting itself. Under stress the casting would break. Thus the brake held but the bearing cap did not. To correct this, the cap bolts of the bearings now go completely through the bearing casting and on through the steel foundation plate as shown in Fig. 2.

Making Portable Engines Secure

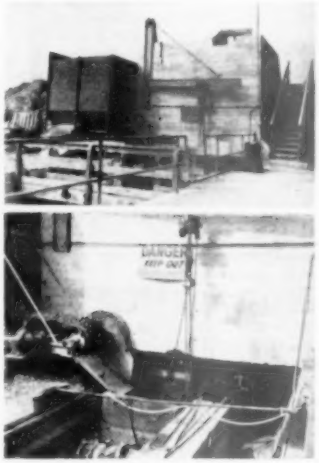
ON A highway construction project in the Southwest two portable Pioneer plants supply the base material. One of these plants is driven by a D-17000 Caterpillar diesel that is flat-belted to

Portable diesel plant held in place by "come-alongs" attached to wheels

the plant. The diesel is rubber-mounted for portability, but when in operation it is blocked up and held in place by two "come-alongs," as shown in the illustration.

Return Circuit for Unwanted Rock

IT WAS FOUND DESIRABLE at a plant in the Southwest to have a method for returning any unwanted sizes to the crushing circuit. This was necessary at times to reclean some of the gravel, and at other times because more finer sizes were desired. The concrete section seen in the illustration is the truck hopper serving the primary crusher. The steel structure at the left is another grizzly-covered truck hopper under which a short belt conveyor is located that delivers the unwanted rock a few feet to the primary crusher.



Top: Truck hopper at left receives unwanted sizes of aggregates for return to primary crusher. Bottom: Conveyor belt used to return aggregate from steel hopper to primary crusher

Mounted over the primary crusher is a swinging boom from which hangs a pair of chain blocks to facilitate crusher repairs. The entire set-up is simple, relatively easy to install, and serves its purpose effectively.

Form Stripping Compound For Pipe

SEVERAL PIPE PRODUCERS have found it expedient to install small bulk storage tanks to handle a form stripping compound called "Hydropel," made by American Bitumuls Co., San Francisco, Calif. Only one quart of the compound is used per sack of cement, so bulky storage tanks were not required. The preparation is added directly to the batch or placed in with the mixing water.

Dust-Tight Feed Covering

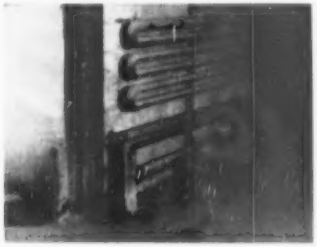
A GOOD EXAMPLE of resourcefulness is afforded by this dust-tight feed housing to the 7-ft. Symons cone crusher at a Western crushed stone plant. The ladders are securely mount-

Dust-tight feed housing over cone crusher

ed and conveniently placed for ready access to the chute in case repairs are needed.

Steel Rails Protect Kiln Walls

AN EASTERN concrete masonry producer has developed a use for scrap steel railroad rails in protecting the



Railroad rails protect kiln walls from damage

walls of kilns. The 75-lb. rails are fastened to the walls about 18-in. above floor level. The arrangement permits lift trucks to maneuver in the kiln with relative freedom from damaging walls.

Thickener Control for Pulp

THERE ARE SEVERAL METHODS of controlling the outlet or pulp discharge from thickeners of the Dorr type. The more common method is that shown in Fig. 1. Here a diaphragm pump circulates the pulp back to the inlet well until the proper pulp density is reached. Once this density is attained, it can be maintained by reducing the stroke or by slowing down the pump, or a part of the pulp could be diverted to the well and the balance discharged to the place of use. This system works well on the smaller thickeners.

A second type that has been observed uses an 8-in. discharge line on a 225-ft. dia. thickener. The density was controlled by means of a hard rubber, disc-like orifice. A wide assortment of these discs were on hand, providing openings from 2½ to 6 in. in diameter. The larger the opening in the rubber disc, the faster the discharge, and hence the lower the gravity of the pulp. To insert these hard

Fig. 1: Diaphragm pump controls pulp density from thickener

rubber discs, the operator made a "T" of welded construction. This resembled an ordinary 8-in. pipe "T" except that a seat was welded on it to hold the disc. This is shown in Fig. 2. The opening "A" was provided with an easy opening hinged gate (not shown) that was held in place by a bracket and wedge. The discs were inserted through this opening. The control valve was installed near the outer edge of the service tunnel under the thickener as shown in Fig. 3.

A third system observed was in connection with a 325-ft. dia. Dorr thickener. In this installation the discharge pulp had to be pumped for a

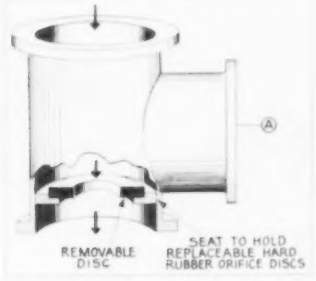


Fig. 2: Replaceable discs control outlet to thickener

considerable distance against a moderate head. The installation is seen in Fig. 4. A steel tank (Fig. 5) about 12 ft. in diameter and of the same height as the thickener was set so that the bottom of the tank and thickener were at approximately the same elevation. Four Wilfley pumps, two 8 in. and two 6 in., were attached to the smaller redwood tank.

To illustrate the operation, when one pump was in use, the pulp line in the small tank would be about at line B. This low head meant a slow movement of the pulp out of the thickener and hence a discharge product of high specific gravity. On the other hand, if all four pumps were on the line, the pulp line in the small tank would ap-

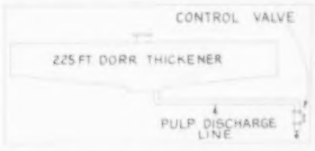


Fig. 3: Placement of control outlet shown in Fig. 2

proach line A. Thus there would be more head or hydrostatic pressure from the higher level of pulp in the Dorr thickener, and the more rapid flow of pulp would result in a pulp of low specific gravity.

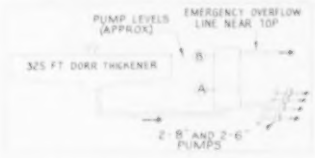


Fig. 4: Pulp control using four pumps

In all cases the operators had a specific gravity flask and a table or chart that was calibrated for the specific gravity of the solids in the pulp. Simply by weighing 1000 cc. of the pulp, its specific gravity or the percent solids could be determined.

Fig. 5: Steel tank of same height as thickener controls head of pressure on discharge line and thus controls specific gravity of pulp

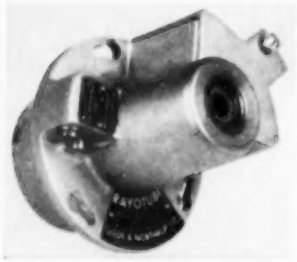
In the installations where pumps were used, the operator started and stopped the pumps as the specific gravity of the pulp changed. Due to the large size of the thickeners, this control was needed very infrequently. Control valves were placed in the discharge lines for added control.

New Machinery

ROCK PRODUCTS

Radiation Pyrometer Detector

LEEDS & NORTHUP CO., Philadelphia, Penn., recently introduced a new Rayotube radiation pyrometer detector for use with all Micromax and Speedomax Rayotube instruments. The detector is recommended for such equipment as slab furnaces and kilns where operating conditions are severe. The unit has the advantages of a quick-sighting optical system, hermetically sealed construction at lens, window and leadwires, and is easily replaced, according to the manufacturer.



Replaceable radiation pyrometer detector

Rear-Dump Hauling Unit

R. G. LETOURNEAU, INC., Peoria, Ill., has announced the E-9 Tournarocker, a new model rear-dump hauling unit designed for loading by shovel, dragline or backhoe. The unit is powered by the It Roadster Tournapull prime mover. It has a 9-ton or 10-cu. yd. heaped capacity. The top opening is 11 x 7 ft.

The Tournarocker is steered by an electric motor, giving a 90 degree left or right turning range, according to the manufacturer. It is able to turn around in a 14 ft. 5 in. radius. Material is dumped behind the rear tires by raising the rocker body with a cable and sheave arrangement. Forward speeds range from 2½ to 25 m.p.h.; reverse speed is 2¾ m.p.h. Multiple disc air brakes are used on all four wheels.

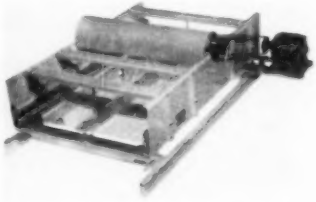
Low center of gravity increases stability in new rear-dump hauling unit

Photoelectric Flame Safeguard

COMBUSTION CONTROL CORP., Cambridge, Mass., has introduced a photoelectric flame failure safeguard system for the protection of manually ignited and semi-automatic industrial oil burners. The system consists of a scanner housed in a dust tight aluminum case, and a control in a separate steel case. The scanner, containing the entire electronic system, including phototube and vacuum tube amplifier, is located on the burner mounting plate in such a way that it has a clear view of the oil flame.

Vibrating Screen Design Improvements

UNIVERSAL VIBRATING SCREEN CO., Racine, Wis., has reported design improvements in its 1950 models, which are said to increase capacity and efficiency. Greater compactness in construction requiring a minimum of space has been achieved.



Improved vibrating screen

All-Purpose Grease Fitting

LINCOLN ENGINEERING CO., St. Louis, Mo., has begun manufacturing a grease fitting which it is claimed will protect bearings by means of a ball check in the head which seals out dirt. The Kleenseal Bullneck fittings, as they are called, are available in a complete range of types and thread sizes, including a self-tapping type.

Motor-Driven Cement Flow Table

AMERICAN INSTRUMENT CO., Silver Spring, Md., is now making a 10-in. dia. motor-driven flow table for testing the consistency of portland cement. This unit meets the latest (June, 1949) specifications of the A.S.T.M., the company states.

Motor-driven flow table meets A.S.T.M. specifications for testing consistency of portland cement

The complete apparatus consists essentially of the 10-in. dia. flow table, motor drive, and bracket for mounting on a concrete pedestal. The motor drive transmits motion to the shaft of the flow table by means of multi-jaw coupling which compensates for minor misalignment in set-up and provides positive, torsionless drive.

The table shaft and cam revolve at 108 r.p.m., which results in 25 drops of the table in about 14 sec. If the motor switch is pulled immediately after the 25th drop, the mechanism will stop before making another drop.

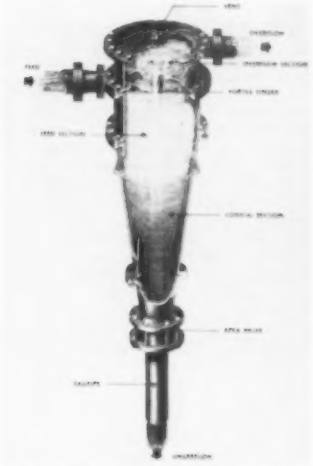
Liquid Classification System

THE DORR CO., Stamford, Conn., has announced that it has acquired exclusive world rights to the DorrClone and DorrClone System for all fields other than heavy-media operations. This is a new method of separating or classifying finely divided solids suspended in a liquid, which the company feels will be an important tool to supplement current practices. The DorrClone, previously termed the HSM Cyclone, was developed by the Dutch State Mines of Heerlen, The Netherlands, and was originally used in their coal washing plants in Limburg.

The DorrClone is a compact cylin-

droconical classification unit which utilizes centrifugal force instead of gravity to accomplish the desired separation, the manufacturer states. It has been found applicable in certain fields for such unit operations as hydroseparation, micron-size separations, and the dewatering of deslimed products.

The phantom view illustrates the principle of operation employed. Feed pulp, a mixture of vari-sized solids suspended in a liquid, enters tangentially under pressure near the top of the cylindrical feed section. The pulp spirals to an apex valve and finally to a tailpipe through which the relatively coarse fractions, thrown out of the pulp by centrifugal force, are discharged as an underflow product. Concurrently, the relatively fine fractions in the feed pulp turn and spiral upwards through the center of the conical and cylindrical sections, and out through the vortex finder as an overflow product.



New system of classifying solids suspended in liquid and employing centrifugal force

The new separator unit is available in 3, 6, 12 and 24 in. sizes. The size in each instance denotes the inside diameter of the cylindrical section. Operating pressures vary from 5 to 100 p.s.i., higher pressures being used for the finer separations. The flow covered by the above sizes ranges from 5 to 600 g.p.m. per unit.

Hard-Facing Electrodes

Stoody Co., Whittier, Calif., has announced a new a.c.-d.c. coating for several electrodes formerly limited to d.c. application only. Among these are the Stoodite, Tube Borium, and Borod. The a.c.-d.c. coated rods do not replace the older d.c. types, but are additions to the regular line. The coatings have a graphite type base said to eliminate slag interference and produce an exceptionally stable arc.

Rear-Dump Truck

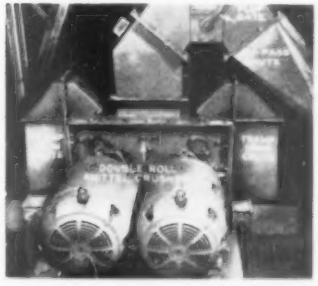
Euclid Road Machinery Co., Cleveland, Ohio, has added the Model UD rear-dump Euclid to its line of earth-moving equipment. This model has a payload capacity of 10 tons and struck measure is 6.6 cu. yd. Other Euclid equipment, bottom-dump and rear-

Rear-dump unit with 6.6-cu. yd. struck measure

dump models, range in capacity from 15 to 40 tons. The Model UD is powered by a 125-hp. diesel engine, and is designed for heavy off-the-highway hauling in construction, mine, quarry and industrial work where a unit of a 10-ton capacity meets job requirements. It incorporates such features as the Euclid planetary drive axle, 10-speed heavy duty transmission, three-stage double acting hydraulic hoist, and free-floating spring mounting for front and drive axles and has a top speed with capacity payload of 35 m.p.h.

Double Rotor Crusher

Stephens-Adamson Mfg. Co., Aurora, Ill., has expanded the application of the standard Knittel unit, the S-A Double Rotor Knittel crusher, to include many materials which tend to clog and reduce crusher capacity. According to the company, power plant installations show that this new unit requires the same horsepower per ton ratio with wet coal that has been achieved on dry coal by the standard Knittel crusher.



Double rotor crusher for coal

The S-A Double Rotor Knittel crusher is equipped with two rotors driven by separate, direct-coupled motors. Synchronization is said to be unnecessary, as the crushing sectors on the rotors operate independently, first splitting the coal on initial impact and then crushing it on the breaker plates. Sized slots in the crusher grate bars determine maximum size of material.

The company states that since the triangular sectors are held in position only by centrifugal force, they are free to adjust position on impact with tramp iron, or other foreign material. Hinged fingers on each side of the crusher allow the sectors to bat tramp iron out without damage to the crusher. Feed openings are reported to be large and the use of only two gangs of sectors on each rotor allows maximum sized lumps to be handled.

Continuous Dust Unloading Valve

Buell Engineering Co., New York, N. Y., has announced the PMF hopper discharge valve designed for continuous withdrawal of dust or powdered material from a collection hopper. The manufacturer claims there is no danger of air in-leakage. The closing shock of the valve disc

Hopper discharge valve for continuous dust or powder unloading

automatically shakes loose all clinging material. The valve's capacity is 103.2 cu. ft. of dust per hour which, in terms of cement, would be over 10,000 lb.

Multi-Purpose Rubber Hose

Carlyle Rubber Co., Inc., New York, N. Y., is producing a new hose capable of handling air, water, gas, oil, grease, paint, alkalies, oxygen, solvents, and many other liquids. According to the manufacturer, this new hose eliminates the necessity and expense of stocking several different types of hose. This product, Vari-Purpose Hose, is said to embody the latest features in hose manufacture and has the following characteristics: specially compounded tube to resist reactions of various elements; braided du Pont Cordura rayon carcass; maximum resistance to working pressures; oil and abrasive resistant cover; light weight and extreme flexibility.

Final washing and screening plant is situated approximately 200 ft. below first plant. Belt, foreground, is part of the upper plant

Caudell and Johnson, San Diego, Calif., subjects sand and gravel to five stages of treatment, including pre-soaking, scrubbing, re-soaking, preliminary to final processing for clay removal

By WALTER B. LENHART

Licking a Tough Clay Problem

WHEN A MINING ENGINEER goes into the gravel business and stays in it for 25 years one can expect that his plant will have innovations that are somewhat different from conventional practices. Mining engineers always seem to do things in a little different manner and in so doing set a pattern that often points the way to methods of producing a better material at a lower cost.

We called at the plant of Caudell & Johnson near San Diego, Calif., because we had heard of a new type of cyclone collector that was being used to recover the finer sizes of sand and to return them to the regular sand produced. If it had been a dry cyclone collector our interest might have been very modest, but this collector was said to be wet, and to operate under pressure. It is probably the first one to be used in any sand and gravel plant in the United States, we were told, so we went to take a look. In the set-up we found several other things that were equally interesting, especially to those operators who have clay troubles. Arthur S. Johnson, president of the company, who is a mining engineer with some 25 years of experience in the gravel business, 13 years at the plant on Friars road in Mission Valley, more than lived up to the operating traditions of the E. M.'s. (Engineer of Mines).

The use of the cyclone-type of wet sand collector stemmed from the character of the material in the pit. The fact that it has more than its share of oxides of alumina and ferrous compounds, clay, etc., was in a measure the reason for designing and building a processing system that is quite different, and which is doing an excellent job of turning out a high quality material. Inasmuch as clay and the objectionable oxides are responsible for plant design and techniques, we will for the moment by-pass the cyclone collector and start this description with the deposit itself, and the method of operating there.

Location

Mission Valley is only a few miles from the center of San Diego, Calif., and is a relatively wide, flat, and fertile valley. Near the plant of Caudell & Johnson the north rim of this valley forms an escarpment that is 200 ft. or more in height. It is a plateau-like structure and practically the entire mass is gravel and sand of the general character previously referred to. The material is of such age geologically that in spots it has the appearance of being almost a conglomerate. Overburden is from 0 to 5 ft. and below it are at least 200 ft. of gravel. Mr. Johnson pointed out that "it's big and it's close to San Diego," so they tied into it and have worked out a successful and economical processing method.

Arthur S. Johnson, president

First of all, after the overburden has been stripped from a large area, 2-in. water pipe lines are installed at the higher points, and every night certain portions of the deposit are irrigated or sprinkled with water from the pipe lines. The soaking for 24 hr. or more of the first foot or so of the pit tends to loosen the clay from the aggregate. Those portions that resemble a conglomerate, after soaking, disintegrate almost by touch, readily freeing the gravel and sand. Any softer sandstone or similar soft materials, due to the soaking, tend to disintegrate in the handling and processing. Dust is also eliminated by the soaking technique.

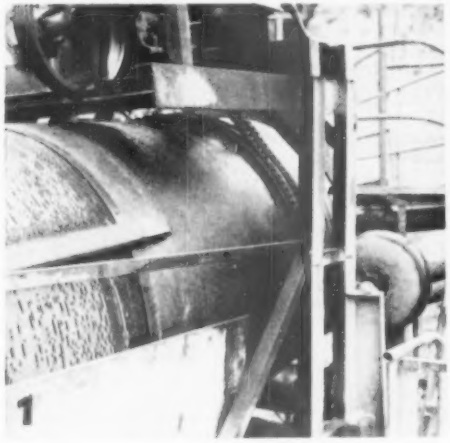
Next, after the irrigation and soaking period, a Caterpillar D-7 tractor hooks onto a Southwest "rooter" and the section to be mined is given a thorough plowing. This rooter is a rugged piece of equipment and consists of two vertical plow members that are about 8 ft. apart. The points dig to a depth of about 2½ ft. It has a rugged steel tongue, and two small steel wheels mounted in front of the plows carry the assembly when not digging. The "Cat" operator controls the digger by means of steel cables and sheaves.

After the rooter has finished, the material is loaded by one of three

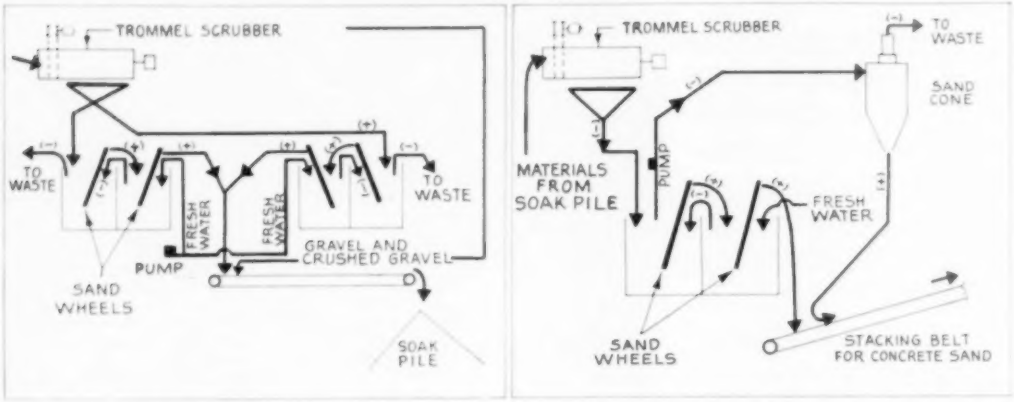
LeTourneau Super C Tournapulls, powered by Cummins diesel engines. Each of these units hauls 18 tons per trip. They load usually on the downgrade and are assisted by a Caterpillar D-8 bulldozer. The maximum haul is about 1000 ft. The three Tournapulls have more capacity than needed, so it is the practice here to use them at full capacity, and after a reserve stockpile has been built up of sufficient size, the four units go to the company's plant at Poway, Calif., about 20 miles east from San Diego. By having haulage capacity in excess of needs, plenty of time is available for repair and maintenance purposes and the labor cost is considerably less for both plants than would otherwise be the case.

The "stockpile" referred to in the above paragraph is another switch, for it really is a "soakpile." The wet material in it receives another 24 hr. or more soaking period. However, to get the material into the soakpile the Tournapulls unload to a hopper under which is a Stephens-Adamson pan conveyor serving a flat belt conveyor. The belt feeds the pit-run to a wet, rotary screen of special design to be described later. Oversize is crushed to about minus 2-in. in a 15- x 38-in. Wheeling jaw crusher. The minus ¼-in. material from the trommel is split into two equal fractions and each fraction is sent to a bank of two inclined, double-wheeled, sand recovery wheels also to be discussed later, for they are installed and operated quite differently from the conventional sand wheel. These four wheels are so operated at this preliminary washing section that about 50 percent of the minus 30-mesh sand is wasted and sent to the channel ahead of the tailing pond.

The plant in which the above processing is carried out is built on the brow of the escarpment above Mission Valley. After all the materials have been processed as outlined, they are all recombined and a stub belt conveyor dumps the wet mixture into the storage or "soakpile" where it is allowed to accumulate below the brow of the escarpment. After the aggregate has soaked there for 24 hr. or more it is picked up by a dragline and the material fed to a hopper; this feeds a belt conveyor that passes under Friars road and delivers the material to the final washing and screening plant. Later some minor changes will be made so that the aggregate in the soakpile will be fed by gravity to the second hopper and the use of the dragline discontinued. By giving the material in the pile this additional soaktime, the clay coatings are loosened on all the aggregates, coarse or fine, to such an extent that in the final sizing and washing plant a material results that competes successfully in the San Diego area and meets all specifications. No clay balls build up in the system, but it was said that before this technique was adopted some trouble with



(1) Feed end of rotary screen is supported by two strands of roller chain that also drive the unit. Smaller roller at right prevents side-sway. (2) Pit-run material is given preliminary wash in trommel screens. Oversize is crushed after which all sizes, including sand, rejoin. (3) Diesel-driven haulage unit brings material to unloading hopper. (4) After soaking, area to be worked is given a thorough plowing



Left: Preliminary sand flow diagram. Right: Final sand washing set-up. All sand wheels are of the same size and design, and all are "counter-current"

clay balls was experienced. The final processing plant features the use of two sets of Garfield and Allis-Chalmers rolls: a set of 54- x 20-in., and a set of 42- x 20-in. A 2-ft. 4-in. Traylor crusher is also a part of the secondary crushing system.

In the second and final treating plant the material from the soakpile is first put through a second trommel screen similar to the one in the plant on the brow of the deposit. The minus ¼-in. concrete sand falls to a double sand wheel of the same design as in the preliminary plant. When we say "double" sand wheel we are referring to the fact that each sand recovery unit has two separate wheels, each operating in its own tank on the "counter-current" principal. That is, the pulp from the trommel goes into the first compartment where the buckets of the 72-in. dia. shovel-type wheel pick up the sand and dump it into the second compartment.

Fresh water is admitted into the second compartment. The sand from this water is picked up by that compartment's buckets and dumped to the stockpiling belt. In the counter-current, the cleaner sand is worked with the clean water. Thus the sand at this point receives two washings, the final of six treatments, for it will be recalled that it has two washings in the two trommels, two in the preliminary bank of sand wheels following the first trommel, and here at the final processing.

The sand wheels all operate in relatively small tanks, but even though the r.p.m. is quite slow there is not sufficient settling time, or area, for the finer sizes of sand to accumulate. So at this last bank of sand wheels, the overflow (which was formerly pumped to waste) is now picked up by the same pump and delivered to the Cottrell wet collector cyclone, and the fine sand that it recovers is put onto the same offbearing belt as the final sand from the wheel.

Separating Cone

The Cottrell separating cone is of cast, wear-resisting metal, rugged in construction and compact. It is about 3 ft. high. The pulp is pumped into it tangentially and the sand is released at the bottom, with the rejects flowing out through the top pipe section. At the bottom a small molasses gate is set to allow the sand to discharge continuously. By raising or lowering the discharge pipe through the flanged seal near the top of the cyclone, adjustments in the cone's operation can be maintained. The pulp goes into the cone at about 20 p.s.i. and comes out at 10 p.s.i. It is known as a 25½-in. machine and was manufactured by the Cottrell Engineering Co., Los Angeles, Calif.

At first pulp was delivered to the cone at the rate of 700 g.p.m., but this produced more fine sand than was required, so the volume of pulp was cut to 500 g.p.m. This decreased the total amount of fines in proportion. The pulp going to the cone is quite thin and the cone is now producing 6 to 7 t.p.h. of sand that has the following screen analysis:

Minus 48-mesh, 100 percent
Minus 100-mesh, 40 percent
Minus 200-mesh, 11 to 15 percent

The discharge product from the cone also contains some minus 325-mesh sand. When the 700 g.p.m. of pulp was going to the machine it was turning out 40 to 50 tons of sand per 8 hr. The sand produced was clean. At the time of inspection the machine had been in the plant 10 weeks, and Mr. Johnson was pleased with its performance. At first he had been a little concerned about the wearing qualities of the cone, but thus far he finds that the wear is not great. If excess wear should develop, a rubber-lined unit may be installed. Before installing the 25½-in. machine some experimental work was tried with a 6-in. cone. The pulp discharging from the cone is on the sloppy side but by bleeding it into the current production of concrete sand (minus ¼-in.), and ground storing the material over reclaiming tunnels, no trouble is experienced. The screen test now is the same as that secured before the reduction in pulp volume.

Overhead storage system includes a small tank, left, which receives pea gravel

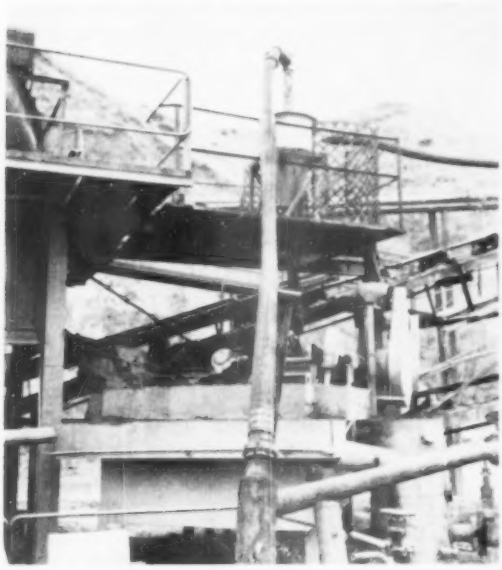
The rotary screens are novel in that only one bearing is used to support the main barrel or drum, and that bearing of the conventional type is at the discharge end of the screen. The feed end of the trommel has no under-supports of any kind, but is carried by the two strands of roller chain that drive the unit. The lower and final screen is 15 ft. long and has a 6- x 6-ft. scrubber drum at its feed end. The sand jacket is ¼-in. cloth. The upper one is similar in design.

Two strands of roller chain pass around the drum and up to two identical sprockets that are mounted above the drum on a steel framework of substantial design. The roller chains are 2 in. As will be seen in the accompanying line drawings and photographs, side sway of the feed end is controlled by two side rollers. Both drive sprockets are powered by the same drive.

The installation of trommels in this fashion has resulted, according to Mr. Johnson, in a foolproof, trouble-free and almost wear-proof unit. By having two sprockets and two strands of identical drive (and supporting) roller chains, should one strand break the remaining one can easily carry the load. Mr. Johnson was not quite sure whether any had ever broken in the many years of operation.

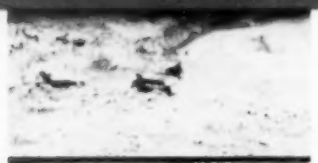
Four sizes of gravel (rock) are stockpiled over reclaiming tunnels. To get as many sizes as possible clustered near the reclaiming tunnel, the pea

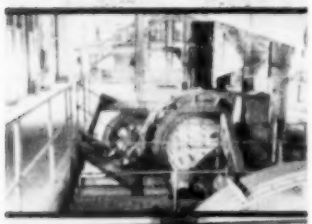
(Continued on page 219)

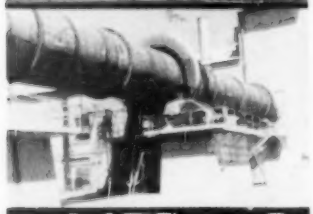


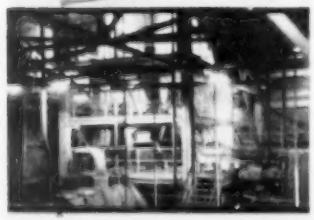
(1) Cyclone sand separator is mounted above sand wheel. Hose, foreground, is carrying away the waste pulp. (2) Closeup of wet cyclonic-type separator. (3) Looking down at one of the twin sand wheels. The two wheels operate in series. (4) Closeup of sand wheel in preliminary treatment plant

CEMENT EXECUTIVES COMMENT ON DISTRIBUTION AND MILL CAPACITY









Majority of manufacturers quoting f.o.b. prices. Productive capacity considered approaching adequacy for normal high demands. Local trends to truck transport noted

By BROR NORDBERG

DUE TO THE FACT that practices in the distribution of portland cement have been, or will be, affected by the high level of railroad freight rates, and because much confusion still exists in the interpretation of whether or not it is legal to absorb freight in order to meet competition, we sought, in our annual letter to the cement industry, to determine whether there has been a movement toward shipment in bulk cement trucks. Other objectives were to ascertain the experiences with truck delivery and the effect of such transportation on the economics of cement distribution, the economical length of haul and whether or not an increasing percentage of cement was being delivered into consignee's trucks at the mill. State highway engineers were also asked to comment on experiences, from their standpoint, with truck-delivered cement.

Demands for portland cement have continued to increase and the result has been that mills continue to be pressed to the limit in all-out attempts to meet requfrements. Accordingly, a reappraisal of opinion in the portland cement industry was sought, as to whether or not present production facilities will be adequate to satisfy demands for portland cement. Finally, inquiry was made as to whether freight was being absorbed or prices quoted f.o.b. mill plus transportation costs, and whether change was contemplated. At the time of our letter, President Truman had just vetoed Senate Bill S.1008—the Freight Absorption Bill—which had been passed by the House and the Senate and which was designed to clarify the legality of freight absorption.

We are indebted to the executives of portland cement companies and highway users of cement who were kind enough, on such short notice, to answer our questions. It is our hope that the summary of opinion as presented here and the various articles that comprise the bulk of this annual August cement issue concerning new plants in the industry and others which have been rehabilitated and enlarged to great extent cover the subjects of greatest current interest to the industry. Replies to our letter are representative of 65 percent of the industry, based on volume of production, which gives authenticity to our summary.

Truck Transportation

There is a growing trend to an increasing percentage of truck transportation of bulk cement in areas where trucks have been in use, and this method of delivery has appeared in some marketing areas for the first time. The trend is on the increase in Detroit, Mich., and throughout Michigan, in the Buffalo, N. Y. area, throughout the Pacific Northwest and California and in all areas where the practice is not new. Truck delivery is

coming into new marketing areas like Pittsburgh, Penn., for the first time and is steadily increasing. In Detroit, an increase of 20 percent in bulk truck movements has been experienced since the war. One Texas manufacturer reported the first shipment of cement from its area to destination by truck. Trucks are serving a dam project involving a 90-mile haul. In California, the proportion of cement delivered by truck is between 75 and 90 percent on the average. In several instances the cement manufacturer owns its own fleet of bulk cement trucks, or owns a carrier company which handles the shipments. In at least two instances, companies have purchased their own trucks recently for the first time, in order better to serve their customers.

The movement to truck transportation is by no means universal. Notable exceptions are the Lehigh Valley mills which ship exclusively by rail throughout the east, the middle west with the exception of Michigan and localized areas within the region, and western mills which must ship long distances to most of its destination points. One of the factors responsible for a trend away from rail haul in certain areas, which might well be to a greater extent when conditions change so that demand for cement is not in excess of productive capacity, has been the shortage of covered hopper cars of the type used to transport bulk cement. Such cars, which were originally designed for use in cement traffic exclusively, are being diverted for other commodities. According to the president of one large cement company, over 80 commodities are now being shipped in such cars.

Truck transportation of bulk cement undoubtedly would be wider spread except for the fact that many plants have been designed exclusively for railroad transportation and, because it would be far too expensive to provide for truck loading. Certainly, the uncertainty as to how cement may be sold, whether f.o.b. mill prices or delivered prices with freight absorption if necessary to meet competition, has made it inadvisable to make plant changes of this character.

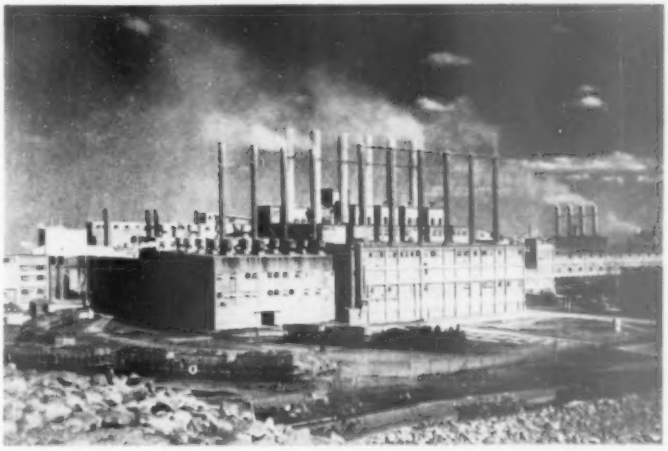
Highway load limits have retarded the use of bulk cement trucks in certain areas. For example, in Texas the rates for trucks are considerably higher than for rail shipments for distances over 30 miles so trucks cannot compete with railroads for intercity movement. In all cases where bulk cement is shipped in trucks the experience has evidently been good from the standpoint of economies and service rendered the customer. Even for long hauls of several hundred miles, it has been found in various areas that prices of cement at destination can be met competitively with trucks where rail-delivered cement is quoted at f.o.b. mill prices plus transportation charges.

The average opinion as to economical length of truck haul, as estimated by cement manufacturers east of the Rocky Mountains, ranges from 100-150 miles. In some cases, hauls up to 250 miles are considered economic in serving ready-mixed concrete and concrete products plants, whereas the same manufacturers place a ceiling of 150-160 miles in serving highway construction projects. On the west coast, the mileages are higher and there is at least one case where trucks haul bulk cement up to 350 miles. The only limit in that instance is licensing fees in crossing state boundaries. The growing number of ready-mixed concrete and concrete products plants located off the railroads has been a factor.

In only one case did a cement manufacturer report that there was an increasing percentage of cement being delivered into consignee's trucks at the mill. Evidently the trend over the country is downward due to individual companies employing their own carriers or owning their own equipment and because the practice is being discouraged in order to expedite service at the mills.

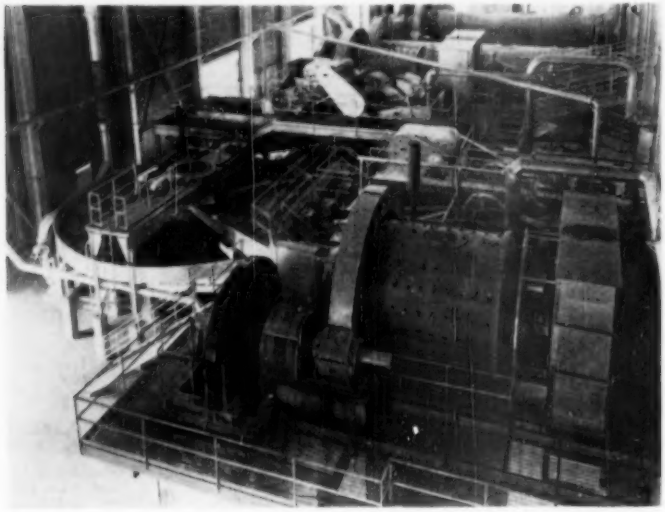
Among the comments by cement manufacturers on the subject of bulk truck delivery, were the following:

A large eastern manufacturer with mills in several states writes, "Deliveries of bulk cement by truck have increased in all areas where such transportation is employed. Much of this increase is the result of an inadequate supply of covered hoppers used by the railroads to transport bulk cement. These cars were originally designed for use in cement traffic exclusively, but now approximately 84 com-



The largest cement plant in the world, Huron Portland Cement Co.'s operation at Alpena, Mich., currently is undergoing expansion with the addition of two kilns and the necessary waste heat boilers and other equipment. This fine view of the plant was taken by William W. Crapo, secretary and assistant treasurer of the Huron firm, who is an accomplished amateur photographer

This hoppered bottom-dump trailer has just been brought out by Gramm Trailer Corp., Delphos, Ohio. It is said to load through manhole openings that are weatherproof when closed and to discharge its load by gravity at controllable speed through the bottom hoppers. The unit is especially applicable to materials having a high angle of repose



Typical illustration of modern raw grinding practice in wet process plant, showing large grinding mills and hydraulic classifying equipment

modities are shipped in them. More hoppers would undoubtedly be beneficial to the railroads in retaining some of the business now being lost to trucking.

"Our experience with bulk deliveries by truck has been satisfactory. Customer reaction indicates that such deliveries are favored due to economies in unloading. Undoubtedly, hauling cement by truck is a permanent mode of transportation, especially where rail service is not available direct to the customer's location. The economic advantages of truck transportation and the expedited service possible through the use of motor trucks appeal to the customers. We prefer to engage contract-carrier trucks to haul for us, but we have found it necessary to operate with our own equipment at one location due to delays being experienced by the intended contract-carrier in receiving necessary transportation permits.

"The economical hauling distance with truck equipment under ordinary conditions is up to 100 miles, at least. The customers generally favor truck delivery for reasons previously explained.

"At two of our locations where we have truck loading facilities, we are unable to load customer-trucks because of congestion. At certain other locations we load customer-trucks, but we have observed no increase in such movements except at times when there are car shortages."

A manufacturer in Michigan: "Each year witnesses an increase in the use of bulk truck equipment. Since the close of the war, I would estimate approximately an increase of 20 percent in bulk truck movements.

"About 45 percent of our distribution moves via bulk truck. For users of bulk cement such as transit-mix operations, products manufacturers, road pavers, general contractors, etc., this is the most economical method and provides the best service. In this area, the rail rates are approximately 15 percent higher than motor carrier rates. Because of the lower scale of rates and the fact that motor carriers provide the better service, motor carriers enjoy the most business. Motor carrier service works well in this territory where a general scale of rates apply over the entire area. This tends to decrease confusion in transportation rates.

"My personal belief is that in servicing normal users, that is transit-mix operators and products manufacturers, 250 miles from shipping point can be serviced with good results. For large users such as road jobs, about 160 miles from shipping point is about the best motor carriers can do and still provide service expected. There is no question in my mind as to the customer's reaction to motor carrier service. This is the only transportation facility that can provide service, and customers desire the services provided by the motor carriers."

A western manufacturer: "There are no facilities for handling trucks at certain of our cement plants. In those areas where we are equipped to deliver cement by truck in bulk, generally speaking, because of higher rail freight rates, there has been quite a decided trend to this type of transportation. We do not own or operate under contract any equipment for the hauling of cement."

A large eastern manufacturer: "At only one of our mills do we do any trucking of cement and there we do it with our own trucking equipment. We do not permit customers' trucks to come to our plants because of the obvious confusion that results from such trucks coming whenever they feel like it and interfering with our own truck loading and our own car loading."

Another eastern manufacturer: "Only within the last couple of months has bulk truck cement been delivered into the Pittsburgh district, but it is definitely on the increase. In the other territories to which we ship, bulk cement by truck has been delivered for some little time and is also on the increase.

Due to increased cost of transportation, the waterways are being put to greater use in the marketing of cement. Shown are the loading dock of Missouri Portland Cement Co. at St. Louis and the type of barge used for transportation on the Mississippi river

"We have not as yet delivered any bulk cement by truck so are not in position to give you our experience on that type of delivery. From our observance of experiences with other companies and from what we hear from dealers, it has been highly satisfactory. We believe that the distribution of cement by truck does fit into the economics if for no other reason than that there is a large percentage of cement users who are not on the railroad and this of course saves them an additional haul. We believe that the economical distribution of cement by truck would not exceed 100 to 125 miles.

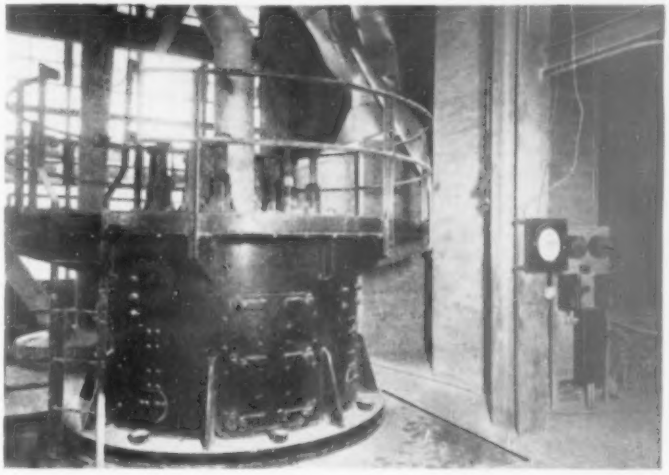
"I do not believe that the percentage of cement being delivered to consignees' trucks at the mill is on the increase. As a matter of fact, I believe it is on the decrease due to the individual cement companies employing their own carriers or owning their own equipment and making the delivery for the consignee."

From the Pacific Northwest: "Our bulk truck cement deliveries have been increasing steadily. Our experience with bulk truck cement shipments has been excellent. We have so arranged our schedule at the mill that we can ship from the mill around the clock. We operate only through common carrier, and charge the common carrier's established rates.

"We haul up to 200 miles from the mill by this mode of transportation, but I would say that 100 to 125 miles is the most ideal distance. We do not make a practice of loading customer trucks at the mill, simply because our facilities are not adequate."

Pacific Northwest: "Bulk deliveries have increased in our area. Within a radius of 50 miles, delivery has been in single truck, end dump. Outside of the 50 mile area, delivery has been in bottom dump trucks and trains with a 110-bbl. capacity. Due to the increased amount of trucking in this area, our plants have had to equip to handle a greater proportion of distribution by truck. We operate a small bulk truck service of our own. Our trucks are end dump.

"Customers are favorable to the elimination of double handling through the use of bulk truck equipment. The economical length of haul in our area appears to be 150 miles. Percentage of cement being delivered into consignee's truck at the mill has been increasing due to the increase in freight rates and larger quantities needed by consignee."



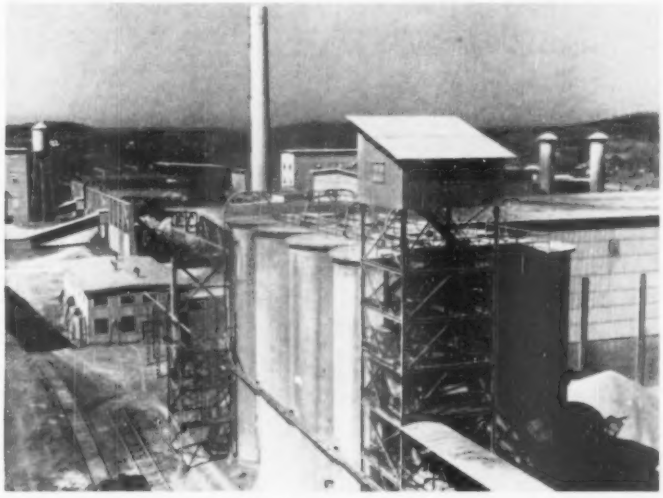
Of great interest to cement manufacturers has been this installation of a ball-bearing type grinding mill for raw materials at Medusa Portland Cement Co.'s Dixon, Ill., dry process plant. The system features compactness and provides for drying materials as they are ground

Pacific Northwest: "In response to your letter of June 23rd, the use of bulk truck-delivered cement is increasing in this area. We have had excellent experience with this type of delivery. We operate our own trucks, and run a maximum of 150 miles with deliveries. Customers are delighted with this service. We find no increase in the number of consignee's trucks picking up cement."

A Michigan manufacturer: "In our area there has been a continued increase in the proportion of bulk truck-delivered cement. However, this increase has been occasioned by the switch from package to bulk rather than by an increase in the use of truck which I presume you had in mind in asking your question. As you probably know, practically all the cement in our immediate area moves by truck. Company-wide at least 90 percent of our product goes by truck.

"We do not operate our own truck equipment but have encouraged the development of substantial and well-financed common carrier trucking companies with uniform tariffs established through the public service commissions, which makes it possible for buyer and seller alike to compute the transportation element of a cement price. In other words, in general in the territories in which we operate, the common carrier truck for cement hauling is a definitely established transportation medium just as much as the railroad.

(Continued on page 196)



General view of a mill that has been modernized. Note the clean appearance of the plant, near absence of dust from the stack and, in the background, the materials storage area which typifies practice in the newer plants

HALLIBURTON PORTLAND CEMENT COMPANY

NAVIGATION BOULEVARD, CORPUS CHRISTI, TEXAS

Closed-circuit grinding of oyster shells separate from other raw materials and instrumentation highlight new plant

By BROR NORDBERG

THE CONSTRUCTION INDUSTRY in Texas, where shortages of portland cement have been extremely critical since the war, has had made available to it 1,500,000 additional barrels of capacity with completion of the new mill of Halliburton Portland Cement Co. at Corpus Christi. Erle P. Halliburton, president and owner of the plant, built the plant at a cost of several million dollars in recognition of the rapid industrial development throughout Texas and in anticipation of a new era for concrete construction. He believes that prefabricated concrete construction, prestressed concrete and other new applications of concrete have great potential in permanently enlarging the applications for cement and, in order to keep pace with population growth and increased industry in south Texas, that water resources, transportation and other facilities must be rapidly developed. The city of Corpus Christi alone provides a substantial market. Its population has doubled with each federal census and now numbers some 110,000 people within its corporate limits.

Since March of this year, when operations began, the new mill has confined its production entirely to the manufacture of standard type I cement to supply the demands of the general trade. Future plans provide for the manufacture of high early strength portland, high temperature oil well cement, masonry cements and for enlargement of the plant capacity by one-half from its present rating of 4000 bbl. daily.

Location of the mill is a 44-acre site on the north shore of the Port of Corpus Christi's industrial canal, adjacent to two railroads. Shipments of cement are made on the Southern Pacific, the Missouri Pacific and Tex-Mex railroads, both in paper bags and in bulk. An additional seven acres have been leased for barge slips and dock facilities alongside the packhouse, for ocean-going freighters. Central American and South American markets may later be developed. Another advantage to the location is ready access to immense oyster shell beds in Nueces Bay which are dredged and processed into cement.

Surplus Equipment Used

Much of the equipment including the kilns was purchased from the War Assets Administration and shipped from the aluminum ore reduction plant at East St. Louis, Ill. Adaption of ore processing machinery to the manufacture of portland cement presented certain complications. Grinding mill specifications, for example, would not be considered optimum for the capacities and finenesses desired in cement manufacture and, as a result, have necessitated considerable ingenuity and experiment in order to be operated effectively. Other obstacles involving adaption to cement manufacture had to be overcome.

In order to manufacture portland cement from oyster shells and clay, it was necessary to build a wet process plant due to the high percentage of moisture in the clay and, for maximum fuel economy, that long rotary kilns be operated. Two 9-ft. 6-in. x 377-ft. kilns were built from 250-ft. kilns as shipped from East St. Louis. In making the conversion, each of the kilns is operated with two induced draft fans in parallel, in order to make use of available auxiliary equipment. Having two draft fans on a cement kiln is not conventional practice, but has proved of advantage because one fan is sufficient to keep a kiln in operation while the other fan might be undergoing repair.

Dual Operation

In other respects, the purchase of a complete ore processing plant for conversion into a cement mill has been adapted to advantage in the design of plant. Duplicate equipment was made available, with the result that the company, in building the plant and in the purchase of new machinery, provided for dual operation and standby equipment for critical operations. Each major division of the plant (or the entire plant) can thus be operated at half capacity, say for one-kiln operation, and function independently of the other half of that department, with dust collectors and all other required equipment in operation. Where one cement pump or one slurry pump will suffice for full-scale operation, there are two, and so on throughout the plant. The mill can produce two

different cements simultaneously and entirely independent of each other.

Much additional new equipment had to be purchased, including the raw grinding classification equipment and thickener, air-quenching clinker coolers, oyster shell dredging and processing equipment, all packhouse equipment, Fuller-Huron airslides for conveying pulverized materials and cement, instrumentation and certain less basic equipment including some feeders, overhead cranes and a diesel power plant.

Construction started in July, 1948, and production of cement was underway early this year, which is creditable performance particularly because of all the improvising that had to be done. The plant is now operating continuously and with very favorable performance when compared to other wet process plants in the industry.

General Layout

Layout of the mill consists of two parallel flows of material as shown on the accompanying isometric drawing. Shell and clay are brought in by barges from the bay into a channel that had to be dredged. These materials are unloaded and handled into storage by overhead traveling crane and are carried right on through the raw mill in a straight-line operation. Slurry is pumped back to the slurry tanks near the waterfront and is put through the two kilns which parallel the raw material flow. Finished cement is pumped through a line under Navigation Boulevard into storage silos. The plant layout provides for a third kiln, and foundations were placed at the time of building for that expansion and for additional milling capacity.

The plant is built on more than 9000 creosoted 70-ft. timber piles and is supported entirely by skin friction. It consists of ten separate buildings of structural steel covered with portland-cement asbestos siding. An air-conditioned modern office and laboratory building, of 10,000 sq. ft. of floor area, was built near the mill.

Erle P. Halliburton, president

Of interest in the construction of the slurry tanks is the use of prestressed concrete by the preloading system (Preload Corp.) whereby 4-in. walls were poured without reinforcing. Prestressing was applied through vertical wires put under tension and spiral wires drawn to specified diameter. Gunite was then applied over the wires on the outside to complete the walls. Use of prestressing permitted thinner walls than ordinarily used and has resulted in the absence of shrinkage cracks.

Design Features

Aside from features already mentioned in discussing the general layout, there are other practices in the mill of special interest which we briefly mention here and discuss later in this article. This plant is the first to use rake- and bowl-type classifiers in the closed-circuit grinding of oyster shells. Shells are ground separately from the clay, and separately from the bauxite and iron ore which are required in small amounts to correct the mix. Each material is pulverized into a separate slurry and so stored in individual tanks preparatory to mixing and blending into kiln feed material.

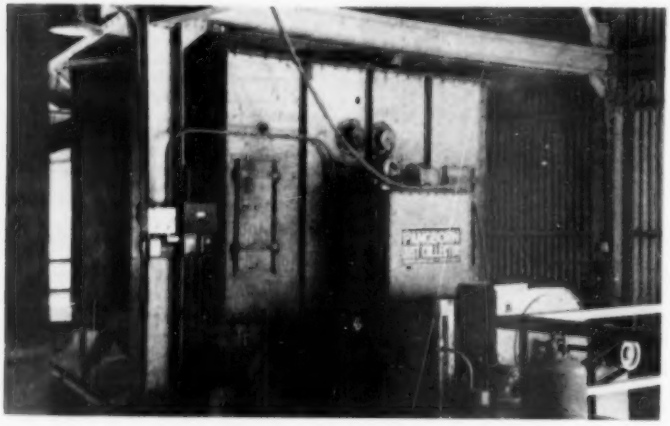
The large number of slurry tanks for storage, mixing, correction and blending is quite in contrast with the facilities in many of the older plants in the industry, and provides the chemist with ideal flexibility and capacity for mix control.

Clinker is not stored in the conventional undercover method with overhead crane for handling and the filling of grinding mill feed bins, but is elevated and conveyed direct from the clinker coolers into concrete silos. Belt conveyors transport the clinker from below the silos into the finish grinding mills. The purpose apparently is to conserve ground space and reduce handling costs while permitting the blending of clinker from several silos over a common belt. This system does not provide for "ageing" the clinker but apparently the industry does not any longer place any stock in the value of that practice even when using large stockpiles for clinker storage. Clinker coolers at this plant are of the air-quenching type with a great over-capacity as compared to those in other plants, enabling cooling the clinker actually to the point of being cold to the hand upon discharge for storage.

Instrumentation

In recent years, there has been an increasing amount of instrumentation in connection with the operation of new, long rotary cement kilns over the country but the kilns at Corpus Christi are more completely instrumentalized than any others we have seen. Furthermore, these kilns are *being operated* by instruments and the instruments are relied upon for quality of clinker and efficiency of production. Advantage is taken of the fact that the leading manufacturers of instruments for kiln control maintain permanent service representatives within easy reach in the area, where they

Left: Diesel-powered tug delivers washed oyster shell to plant. Right: Eleven-ton, 100-ft. span crane serves shell storage section



Dust collector in clinker handling department

are stationed to serve the oil and gas industries. The cement company has a contract whereby regular servicing of instruments is done and so that emergency service is quickly available.

Among other interesting features are the extensive use of Fuller-Huron airslides in the packhouse and in the finish mill grinding circuit, and the flexibility of arrangement for loading out cement from the cement silos (see the drawing on page 123). Electric power requirements are supplied by oil-gas engine-generator sets, with emergency standby capacity, and the kilns are fired with natural gas.

Raw Materials

Oyster shells are dredged from reefs in Nueces Bay. The reefs run up to 75 ft. in thickness and are near the surface. Some of them extend above the water. The shells are contaminated by clay and sand carried into the bay by Nueces river, making the beds alternately of clay and shell. This clay is high in alkalies which necessitates thorough washing and scrubbing of the shells. It also contributes to tough digging which requires a powerful cutter and pump in excavating the shells.

Each reef differs in thickness and the degree of washing necessary. A typical analysis of the shell is 90 to 95 percent $CaCO_3$, 0.5 percent Al_2O_3 and 0.5 percent Fe_2O_3. The balance is silica, mainly left inside the shells, and the magnesia content is extremely low. Daily requirement is 936 tons of shell ground to produce 4000 bbl. of clinker, but average dredge production is 1200 tons per day.

Clay

Clay is obtained from a nearby tract on the north shore of the bay and is excavated by a 1½-cu. yd. diesel-powered Marion dragline, with Esco bucket loading directly into barges. This clay is deficient in alumina and iron. Bauxite is shipped by rail to the plant from Arkansas and the iron deficiency is corrected by blending into the mix classifier sand rejects shipped by rail from the Kaiser plant at Baton Rouge, La. The total bauxite and iron required for correction is about 1.0 percent.

Dredging Shells

Shells are excavated by a hydraulic dredge with 18-in. suction and 16-in. discharge, using a 4-ft. Amsco cutter 45 ft. in length which is gear-driven by a 75-hp. Westinghouse motor. The pump is also of Amsco manufacture driven from a 900-hp., 12-cyl. General Motors diesel engine. Other operating equipment aboard the dredge includes a 12-in. Amsco-Nagel wash pump; a 300-hp. Chicago Pneumatic diesel engine driving a 440-volt Electric Mchy. & Mfg. Co. alternator and exciter for power supply to the auxiliary motors; an American Hoist and Derrick Co. hoist to handle the swing lines and spud lines; and a Fairbanks-Morse 440-volt lighting circuit.

Operating controls are by air, including Westinghouse air-brake controls. An air clutch engages the diesel engine to the gear box from which the dredge pump is driven. The dredge hull is of steel construction and measures 26 x 104 ft.

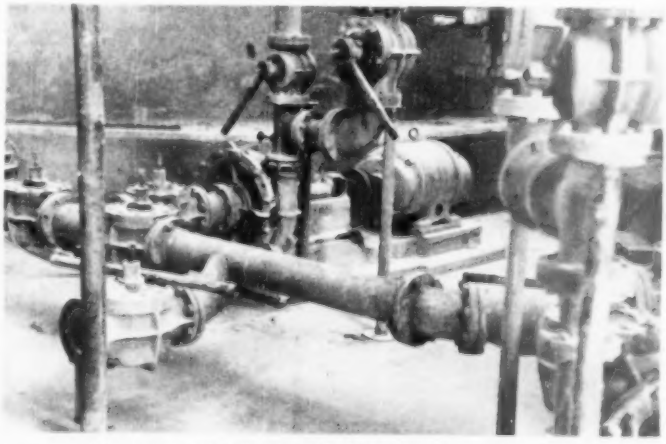
Shell Washing

Shells are washed and screened aboard the dredge and loaded into 26- x 104-ft. steel barges carrying 200-300 tons. The pump discharges over an 8- x 12-ft. stationary screen sloped at 60 deg. where water is applied under high pressure. The screen has two decks carrying 1-in. and ⅜-in. square openings on the top and bottom decks respectively. Shells are then put through a 10- x 30-ft. revolving scrubber-screen where water sprays are applied at 60 p.s.i. The revolving screen rotates on a fixed bearing at the discharge end and a tire at the front end. Internal lifters give a spiral action and screw out the material, and louvres were installed to protect the screen cloth.

Hauling by Barge

Floating equipment, in addition to the dredge, consists of four barges for shell, two for clay, a towboat powered by a 165-hp. GMC diesel engine and a service boat driven by a Chrysler marine engine. Barges and dredges were built to a width established by the permissible clearance of two drawbridges at entrance into the bay, by the Marine Division, Maxon Construction Co.

The dredge was engaged for 90 days, prior to the start of operations, in excavating a 10-ft. channel into a slip at the plant where an 11-ton overhead Milwaukee traveling crane with 5-cu. yd. Blaw-Knox clamshell bucket empties the barges. Average length of barge haul is one mile.



Slurry pumps which deliver from kiln feed tanks to slurry feeder tanks

Overall view of Halliburton Portland Cement Co. plant at Corpus Christi, Texas

Raw Material Storage

The overhead craneway extends 700 ft. in length, and the total storage area is roughly 500 ft. long by 100 ft. wide for a total storage of 22,000 cu. yd. of shell. There is sufficient storage for shell and clay to guarantee 45 days of operation.

Within the storage area at the end adjacent to the raw mill building there are two parallel rows of three concrete silos, each of which has a live storage capacity of 300 tons. These silos, and all others in the plant, have 45-deg. hoppered bottoms, and are self-cleaning. Shells are handled into the silos by the overhead traveling crane and are drawn from below on to a 30-in. belt conveyor under each row which inclines upward for direct feed, in each case, into the primary grinding mill. Rate of feed on to the belt is regulated by Schaffer Poidometers. There are two of these units, rail-mounted, under each row of silos.

One of the six silos is alternately used for the storage of bauxite and iron ore screenings. These materials are received by rail alongside and transferred by a Barber-Greene car unloader into the boot of a bucket elevator for direct filling of the silo. About once each four months a batch of bauxite slurry and one of iron ore slurry are made through wet grinding in open circuit through one of the primary grinding mills.

Clay is stored behind the silos, for transfer into a feed hopper by the overhead crane. A reversible 36-ft. Amsco pan conveyor regulates the flow of clay on to the belt conveyor from which the primary grinding mill is fed. Normal practice is to pass the clay through No. 1 primary mill in open circuit, this being the same mill through which the bauxite and iron ore are separately ground.

Raw Grinding

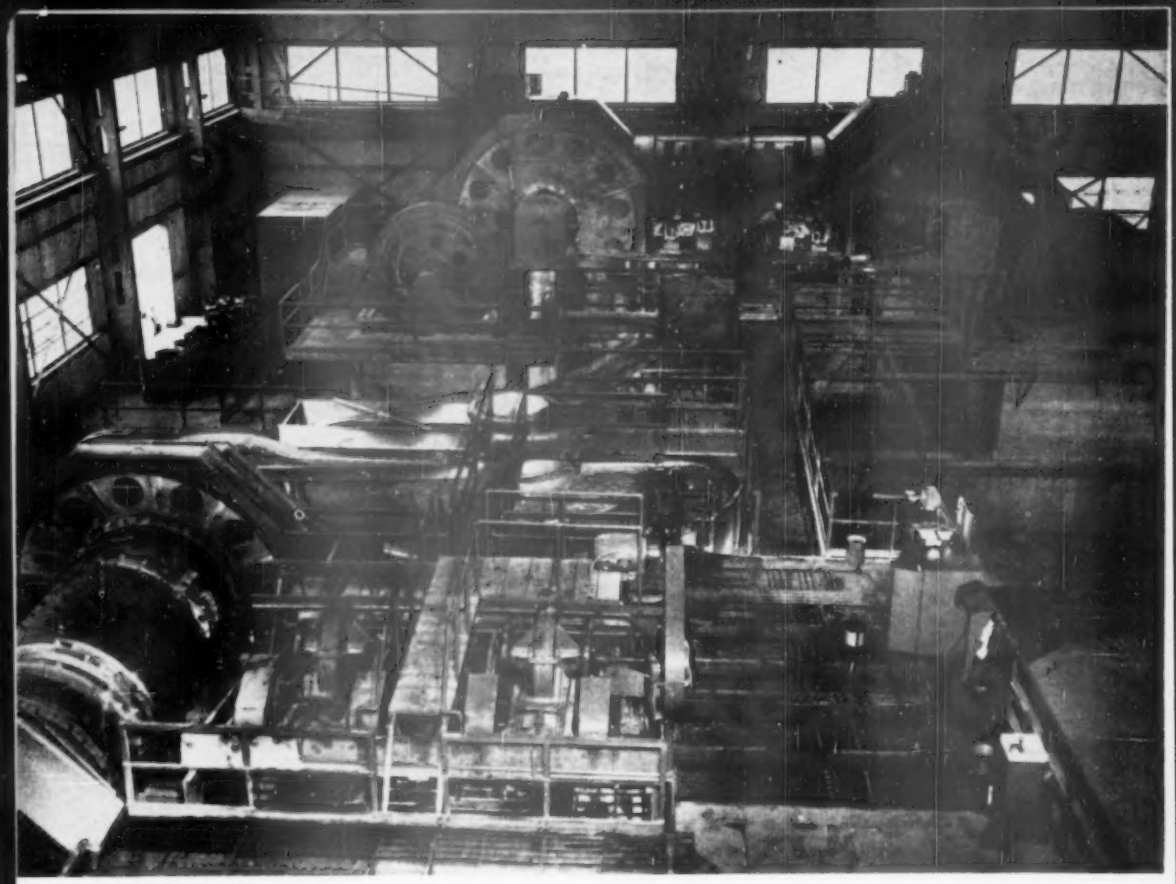
Since this is the first time that grinding of oyster shell in closed circuit with rake- and bowl-type classifiers has been attempted in a cement mill, a number of problems have been encountered which are new to the industry.

One of the problems peculiar to oyster shells is the wide variation in hardness of the shell. The edges, or knuckles, at the hinges of the shells are much harder than most limestones whereas the rest of the shell is relatively soft and tends to flake in grinding. This tendency to flake makes it difficult to thicken the slurry to favorable consistency for kiln feed. Thus, the problem, which has in the past discouraged adoption of closed-circuit grinding systems like the one in use, becomes one of reducing the hard hinges to a fineness which will not require over-burning in the kiln with danger of high free lime, while holding within practicable limits the amount of extremely fine flaky particles which are difficult to settle. It amounts to milling to 92 percent minus 200-mesh for kiln feed and attempting to approach 60 percent solids from the thickener in order to conserve fuel. The fines that are troublesome are the 325-mesh fraction.

Shell are pulverized by two-stage, closed-circuit grinding. An 8- x 16-ft. Allis-Chalmers mill, fed shell direct by belt conveyor from silo storage, is closed-circuited with a Dorr rake classifier and a separation is made at 40-mesh. The rakes are 5 ft. wide and the classifier measures 28 ft. 6 in. in length.

Bowl Classifier

Sands are returned into the mill by a scoop feeder and the weir overflow is laundered into a 16- x 39- x 25-ft. Dorr bowl-rake classifier which is operated in closed-circuit with an 8- x 16-ft. Allis-Chalmers secondary mill. A separation at 92 percent minus 200-mesh is made in the bowl. The overflow, containing 15 percent solids, is pumped from a sump by a 6-in. Morris slurry



In raw grinding department, preliminary mill is in left background, and bowl-rake classifier, center. Mill in foreground is closed-circuited with bowl-rake classifier. Mill at right background is used normally to grind clay, bauxite and iron ore screenings in open circuit and may be used on occasion to grind shell

pump into the thickener. Sands are laundered into the secondary mill.

Second Primary Mill

There is a second primary mill (No. 1) which also receives its feed by belt conveyor. This mill is only operated part of the time and is used for separate open-circuit grinding of clay, bauxite and iron ore. When grinding shell, it is in circuit with a rake classifier which overflows into the single bowl-rake classifier. Normally, the single two-stage grinding circuit is sufficient to grind the required 44 t.p.h. of shell.

Both primary mills were converted from compartment mills into tube mills to minimize over-grinding before classification. They had too great length for grinding shell; that has a tendency to have too much 325-mesh fines when ground. The conversion has shortened the effective grinding length. The mills were redesigned for low level discharge and lifters were inserted all the way to the back of the discharge grate to expedite through travel. Feeders for return of circulated material into the mills are drum feeders with spouts. A 72-in. scoop, 24-in. wide, is used for the purpose.

While ball charges are under constant experiment in plant operation and the loadings may later be changed according to experience, it has been determined that maintenance of uniformity of a given charge is important to uniformity of results. At the time of our inspection of the plant, each primary mill was carrying 63,950 lb. of forged steel grinding media consisting of 11,440 lb. of 4-in. balls, 16,680 lb. of 3½-in., 17,230 lb. of 3-in., 10,500 lb. of 2-in., and 8,090 lb. of 1½-in. size. The loading was being maintained heavy in the large sizes to hold down the fines and in order to break more effectively the hard knuckles at the hinges of the shell. These hard knuckles are subjected to repeated impacts, of course, as they are recirculated through the mill.

Primary Mill Drive

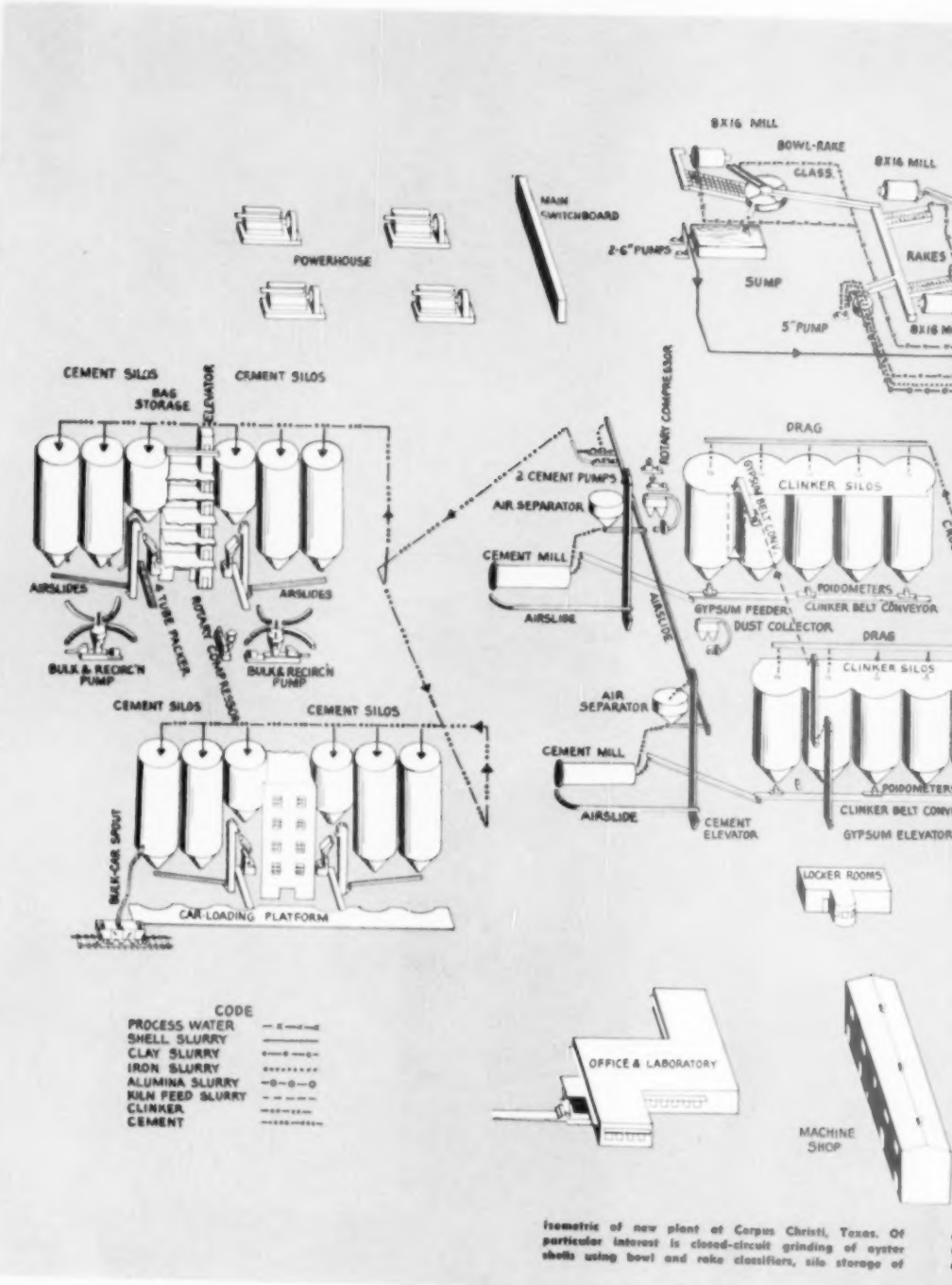
The primary mills are driven by 450-hp., Electric Machinery Manufacturing Co. synchronous motors at 18.82 r.p.m. through a 9.55:1 gear reduction. Motors have the inching feature to spot the mills for charging grinding balls. Make-up balls are 4-in. diameter and are added on the average of at least once a week according to the motor load, which is maintained at 58 amperes (4160 volts).

Secondary Mill

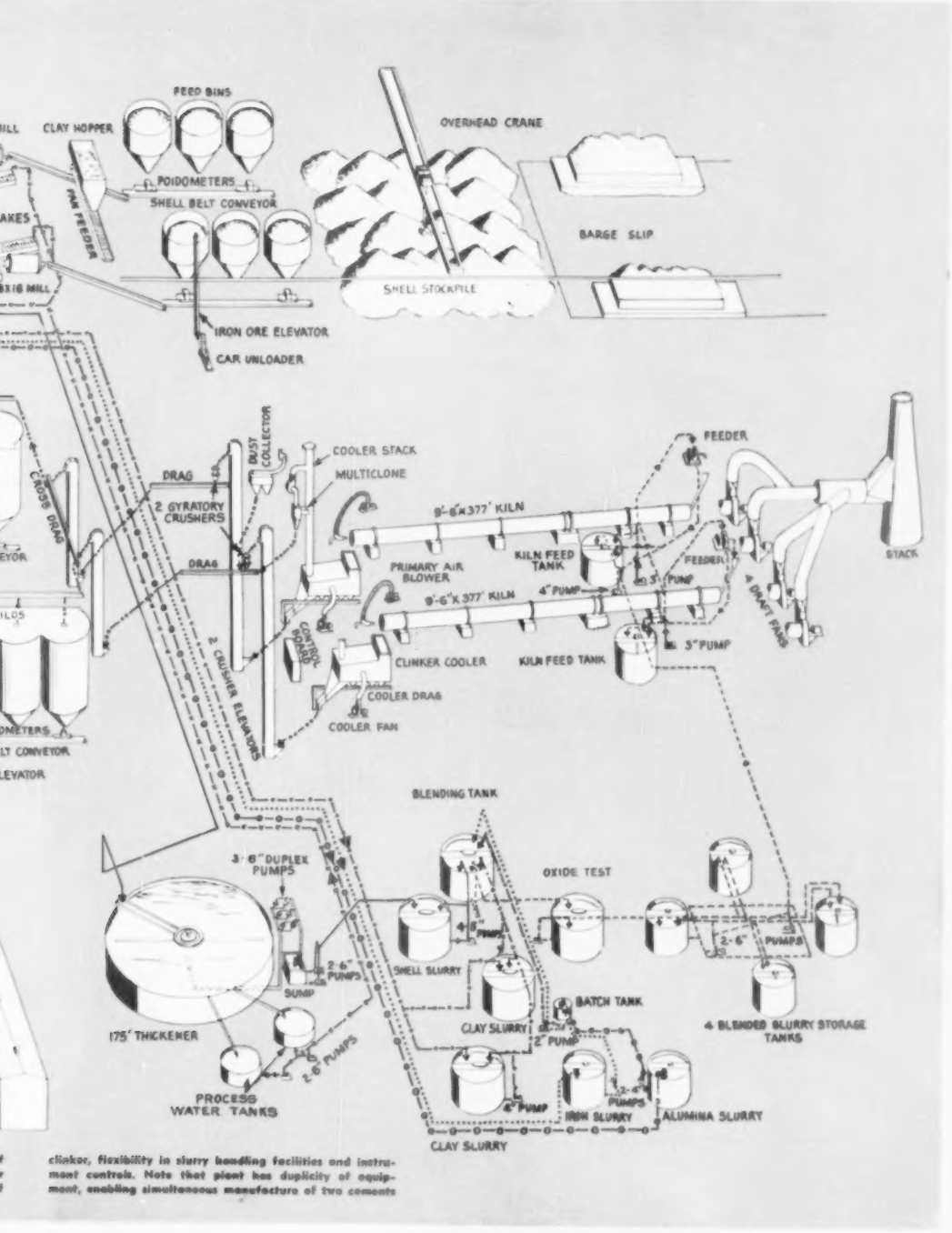
The secondary mill is also considered too long but is being operated as a 2-compartment mill. It has a drive identical to that of the primary mills. The ball loading is a light charge and of relatively large balls in order to minimize 325-mesh fines. Two-inch balls are carried in the first compartment and, in the second compartment, 40 percent of the charge is 2-in. balls and 60 percent of 1½-in. balls. Ball additions are added to hold a mill load of 56 amperes.

Due to carrying light loadings in the mills, since operations are governed by the rate of thickening, to balance output according to use, actual power consumption is only 800-hp. in producing shell slurry for the daily production of 4000 bbl. of clinker. This is done with 20 percent shutdown time.

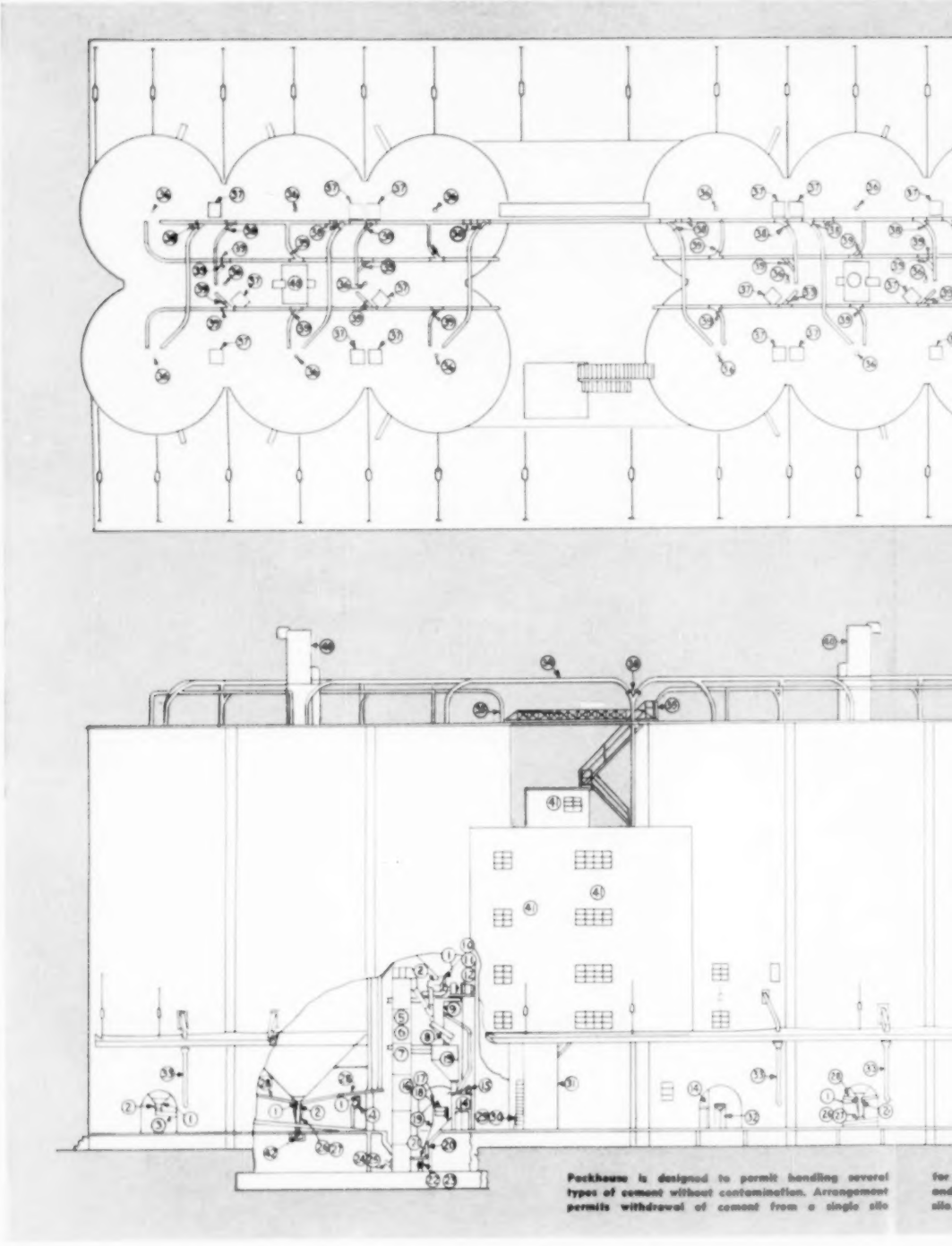
Interlocking switches were provided throughout the raw grinding department so that all equipment drives will kick out automatically in event of a



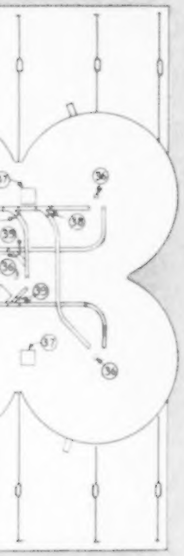
Isometric of new plant at Corpus Christi, Texas. Of particular interest is closed-circuit grinding of oyster shells using bowl and rake classifiers, silo storage of



clinker, flexibility in slurry handling facilities and instrument controls. Note that plant has duplicity of equipment, enabling simultaneous manufacture of two cements

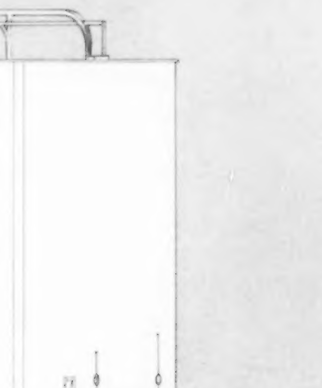


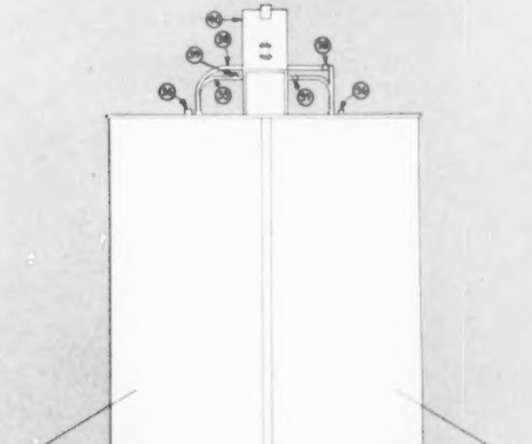
Packhouse is designed to permit handling several types of cement without contamination. Arrangement permits withdrawal of cement from a single silo



LIST OF EQUIPMENT

No.	Qty.	Item	Description	Mfr.
1	64	Feed Cut-off Gates	Sliding Plate	
2	32	Air Feeders		
3	4	Packer Feed Aerovators	10"	
4	22	Feeder Valves	14" Gate	Fuller Co.
5	4	Cement Elevators	8"x12" buckets—70 t.p.h.	Link Belt
6	2	Elevator Drive Reducers	15 hp.—120 DB—88.5 1 Ratio	Foote Bros.
6	2	Elevator Drive Reducers	24 hp.—120 DB—88.5 1 Ratio	Foote Bros.
7	4	Elevator Drive Motors	20 hp. — 1800 r.p.m.	Louis Allis
8	4	Packer Screen	4 cell w. vibrator	W. S. Tyler Co.
9	4	Packer Dust Collectors		
10	4	Dust Collector Fans		
11	—	Fan Drive Reducer		
12	4	Fan Drive Motor		
13	4	Packer Surge Bins	370 cu. ft. cap.	
14	4	Packers	4-tube Madison valve	St. Regis
15	4	Packer Motors	10 hp. — 1200 r.p.m.	Louis Allis
16	4	Bagged Cement Conveyors	30" Woven Wire Belt	
17	4	Conveyor Drive Reducers	7½ hp.—7 DA—54.07 1 Ratio	Falk
18	4	Conveyor Drive Motors	7½ hp. — 1200 r.p.m.	General Electric
19	20	Spill Chutes		
20	4	Spill Aerovators	8"	
21	4	Spill Aerovators to Elevators	8"	
22	4	Spill Pumps	5" Type H	Fuller Co.
23	4	Spill Pump Motors	15 hp. — 1800 r.p.m.	Louis Allis
24	4	Spill Pump Air Compressor	C 50-220c.f.m. — 30 psig	Fuller Co.
25	4	Air Compressor Motors	30 hp. — 1800 r.p.m.	Louis Allis
26	2	Ship Bulk-load Pumps	8" Type H	Fuller Co.
27	2	Bulk-load Pump Motor	150 hp. — 1200 r.p.m.	Elec. Mach'y Mfg. Co.
28	8	Pump Feed Aerovators	12"	
29	1	Bulk-load Compressor	C 300 SS	Fuller Co.
30	1	Compressor Motor	300 hp. — 575 r.p.m.	Elec. Mach'y Mfg. Co.
31	1	Freight Elevator	2000 lb.	Otis Elev. Co.
32	4	Bagged Cement Loading Table		
33	12	Car Loading Spout	8" pipe	
34	—	Filling Line from Bldg. 1	8" pipe	Fuller Co.
35	—	Spill Return Line	5" pipe	Fuller Co.
36	16	Inspection Openings	12" dia.	
37	16	Manholes	20"x30"	
38	18	Filling Line Gates	8" Line Blinds	Hamer Oil Tool Co.
39	20	Spill Line Gates	5" Line Blinds	Hamer Oil Tool Co.
40	2	Dust Collectors		
41	11	Steel Sash Windows	033141	
42	—	Bulk Cement to Dock	8" pipe	Fuller Co.





for simultaneous bulk-loading into railroad cars and into ships while packing cement from the same silo. Air feeders and air conveyors are used throughout

failure in equipment ahead. If the bowl-rake classifier is stopped, for example, the mills, rake classifiers and shell feed belts will stop. No. 2 primary mill is put into service by turning a selector switch.

Grinding Control

Main means of control of grinding is through setting of the weir on the primary rake classifier to create sufficient pool to effect a separation at 40-mesh, and the application of water. Solids out of the primary circuit into the bowl-rake classifier are maintained at 60 percent. Water is added in the scoop case and through sprays in the primary rake classifier. Similarly, water is added in the rake section of the bowl-rake classifier to maintain 15 percent solids in the overflow which is pumped to the thickener. A 300 percent circulating load is carried in both the primary and secondary grinding circuits.

Due to the grinding characteristics of the shell, the final product is still extremely high in 325-mesh particles with the result that the thickener thus far has only been effective in producing an underflow of 55-56 percent solids. This has not proved serious in view of the low unit power cost and because natural gas to fire the kiln is relatively cheap in Texas. However, it is planned to install a disc filter to de-water a sufficient portion of the thickener underflow, for repulping with the balance of the underflow in a turbo mixer to yield a product of 62 percent solids from the thickener into the slurry tanks.

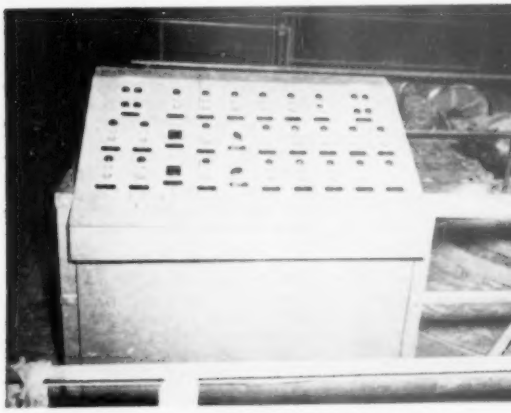
Shown below are the results of a

Four blende

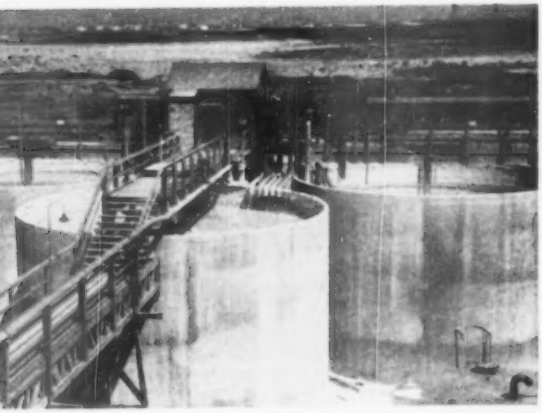
spot check made M
centages of solids an
tribution out from
cuit for a productio
slurry with a circul
percent.

It will be noted fr
the percentage of
is exceedingly high
flow and that the
primary rake sand
rake sands is very
cates excellent ope
closed-circuit perfor
ed. The very high a
fines in the bowl ov
characteristics, isn't
but is sufficiently hi

	Percent Solids	Percent −20 M	Percent −40 M	Percent −100 M
Primary rake sands	74.4	36.63	24.33	14.52
Primary rake overflow	31.0	96.70	86.60	69.43
Primary mill discharge	65.6	83.61	67.59	48.60
Secondary rake sands	66.4	98.49	88.25	58.86
Secondary mill discharge	61.2	99.92	97.14	71.00
Bowl overflow	12.8	100.0	99.99	96.87



Main control board for raw mill



blended slurry storage tanks from which kiln feed tanks are filled

de May 15 on the per-
ids and particle size dis-
from the grinding cir-
duction of 44 t.p.h. of
circulating load of 300

ted from the above that
e of 325-mesh particles
high on the bowl over-
the percentage in the
sands and secondary
very low, which indi-
t operation insofar as
performance is concern-
igh amount of 325-mesh
wl overflow, due to shell
, isn't always that high
tly high to retard thick-

nt M	Percent -200 M	Percent -325 M
32	8.53	5.60
43	54.03	50.19
50	37.20	36.30
56	11.14	7.42
00	43.29	34.43
67	91.70	78.42

ening. Attempts are continuing to be made to lower this fraction by changes in grinding ball sizes, and in circulating loads and percentages of solids carried.

Slurry Thickening

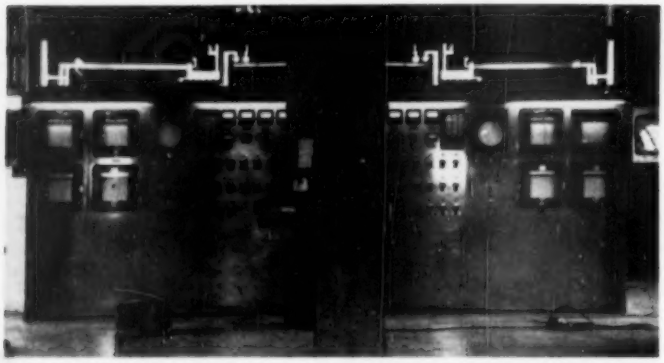
Bowl overflow is into a sump from which one of two 6-in. (one standby) 2000 g.p.m. Morris slurry pumps driven by 100-hp. motors delivers the slurry into the thickener. The thickener is 175-ft. diameter with 330,000 cu. ft. volume and has a mechanical arm turning at the rate of one revolution in 45 minutes.

Underflow from the thickener is withdrawn by three Dorr Duplex 6-in. adjustable diaphragm-type pumps inserted in the flow in order to regulate accurately the amount of material to be pumped into the shell slurry tanks. These pumps discharge into a sump, from which two 6-in. Morris pumps transport the material into the shell slurry tanks. This method of relaying is preferred to the use of pinch valves which may cause plugging of the lines.

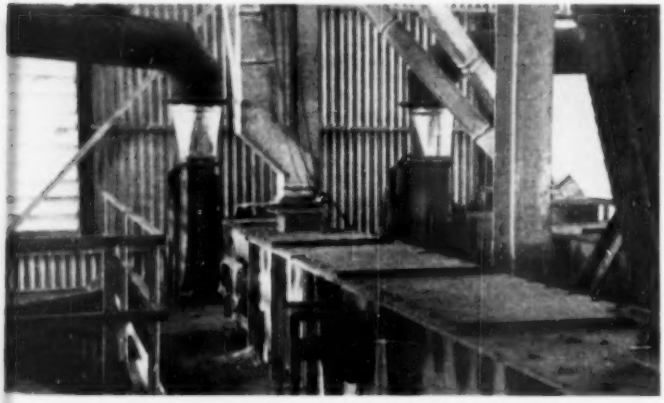
Overflow from the thickener is clarified in two process water tanks from which two 6-in. Dayton-Dowd pumps return the water to the grinding circuits in the raw mill. Because of a water scarcity in Corpus Christi, makeup water is that used for cooling in Fuller compressors in the finish mill and that used for mill bearings and the kiln trunnions.

Iron Screenings and Clay

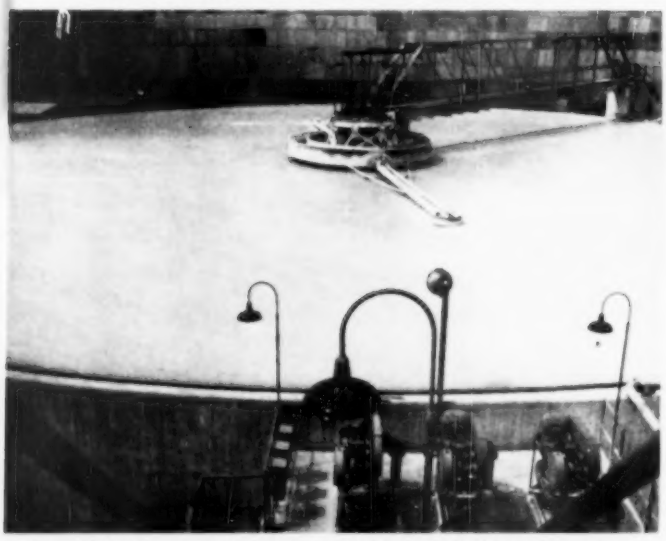
Iron screenings and bauxite are ground into 90 percent minus 200-mesh slurries for separate handling and storage. The clay is put through the mill as fast as possible, mainly to break up lumps, and has a fineness of 92 percent minus 325-mesh as a slurry. By not using a separate wash mill, as practiced in the majority of plants, it is unnecessary to intergrind the clay with the shell. These separate slurries



Instrument board for two kilns. Note schematic illuminated flow of plant above for quick detection of breakdowns



On left is primary air fan for natural gas firing. Conveyor is for clinker



Three diaphragm pumps withdraw thickener underflow for regulated feed to slurry pumps

are pumped into their tanks by a 5-in. Morris slurry pump.

Slurry—Storage and Blending

As shown on the isometric drawing (page 122), each of the four materials entering into the manufacture of cement clinker is handled as a separate slurry, and there are sufficient slurry tanks for storage, blending and correction to provide the utmost in facilities for control of mix.

All the slurry tanks are 25 ft. high. Five of them, including the tank for shell, one for clay, one for blending and two for oxide corrections, are 55 ft. in diameter. There are four 40-ft. diameter blended slurry tanks and two of 35-ft. diameter for iron and alumina slurries. All are equipped with Dorr mechanical and air agitation. Procedure is to pump shell slurry into the blending tank, and clay from the clay slurry tank into the blending tank, using 5-in. slurry pumps. The proper percent calcium carbonate is then determined. Clay slurry can be recirculated and transferred. Iron and alumina slurries are drawn into a batch tank from which a 2-in. pump transfers the batch into the blending tank. The blending tank has a 5-in. slurry pump for recirculation and for transfer to the oxide test tank which also has a 5-in. pump for recirculation and for transfer into either of the four blended slurry storage tanks. It is from these tanks that kiln feed slurry is pumped into a pair of kiln feed tanks beneath the kilns by 6-in. pumps. All the slurry pumps are of Morris manufacture.

Slurry Correction

With this arrangement there are a number of possibilities in the blending and correction of slurry. For example, a pair of the blended slurry tanks might be for slurry at the determined holding point while one of the other two would have a percent low $CaCO_3$ and the fourth a percent high for correction purposes. They could then transfer to the blending tank. Then, after correction, the transfer would be to the kiln feed tanks. As it is, slurry is in various stages of preparation and correction up to three days before burning in the kilns.

A pair of blended slurry tanks has sufficient capacity for burning 4000 bbl. of clinker, the two kiln feed tanks together for a day's operation, while the blending tank and the correction tank each hold sufficient slurry for one day's operation.

Storage Capacities

Requirement for a barrel of clinker is 600 lb. of raw materials. Storage capacities, on a dry weight basis, are as follows:

Shell (slurry) 2800 tons at 56 percent solids
Clay (slurry) 2400 tons at 38 percent solids
Shell (thickener) 2200 tons

Iron (slurry) 970 tons at 58 percent solids
Bauxite (slurry) 544 tons at 50 percent solids
Blended mix 2766 tons at 50 percent solids

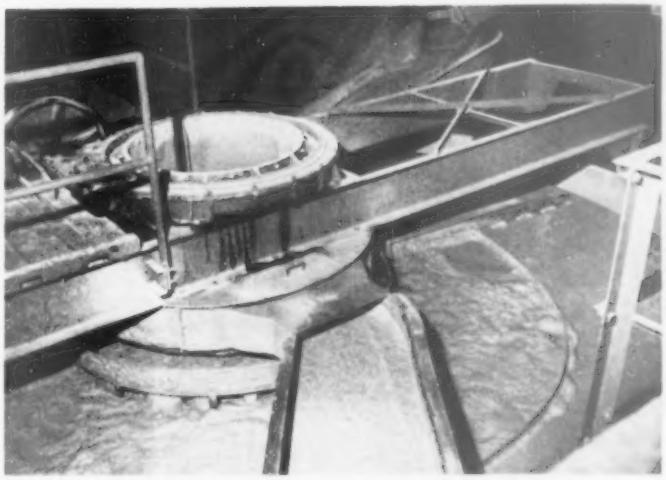
In terms of clinker, the shell available in storage, including unprocessed shells, the thickener and storage tanks, is sufficient for 92,000 bbl. or 23 days of operation. For clay, storage is sufficient for 80,000 bbl. or 20 days' operation, iron for 360,000 bbl. or 90 days, bauxite for 200,000 bbl. or 50 days, and the blend is sufficient for 19,820 bbl. or 5 days' operation.

Kilns

The two kilns are 9 ft. 6 in. in diameter by 377 ft. and were fabricated from 250-ft. Traylor kilns. Each rides on six oil-film rollers, carries a slope of ½ in. to the lineal foot and is driven at 75 r.p.h. by a 100-hp. G.E. 440-volt motor. There is a 100-hp. airmotor drive available for emergency in case of power failure; this is engaged to the gears through a dog clutch. The kilns are fed slurry by ferris wheel feeders which are synchrotied to Allis-Chalmers alternators driven off the kiln drive.

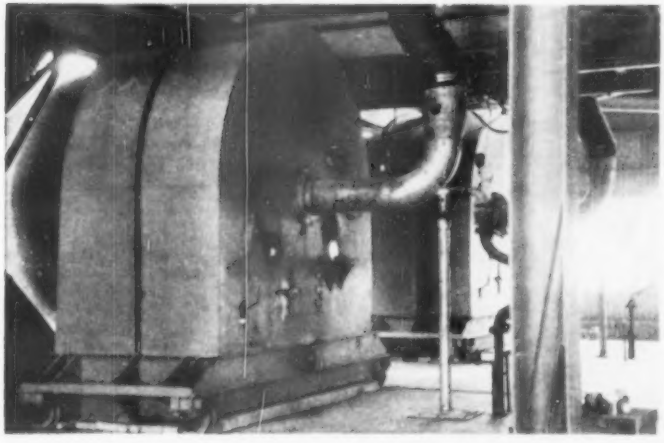
Nose rings of the kilns are 25 chrome-12 nickel alloy castings which will be lined with 9-in. standard abrasion-resisting brick. The present 70 percent alumina 9-in. hot zone lining extends from the nose ring for a distance of 110 ft. Then follows 177 ft. of 6-in. 50 percent alumina brick and 70 ft. of 4-in. high-silica abrasion resisting brick through most of the chain section. The 9-in. brick in the hot zone is to be replaced by 6-in. brick after operations have been stabilized and the brick are worn out.

There is 77 ft. of chain section starting 20 ft. from the back end of the kiln. It is a dense pattern designed to eliminate balling up of slurry and designed for maximum heat transfer due to the abnormally high moisture content of the slurry. The system is a combination type with counter spirals that hang freely in such a way that when they come up from the slurry each chain cleans itself by single-point rubbing action on the next chain.



Bowl-rake classifier in raw grinding circuit for oyster shell, showing launders for feed of primary rake classifier overflow and secondary mill output into bowl

Kilns are fired natural gas simultaneously with primary air blast. Note mechanical tie to hold air-fuel ratio constant

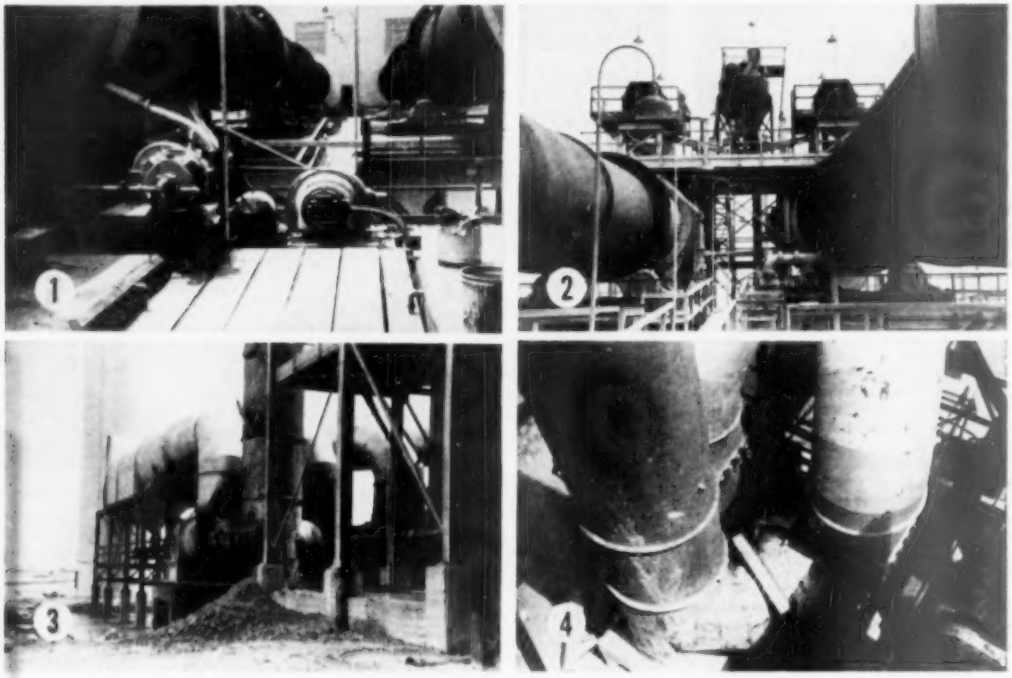


View of firing hoods for both kilns. Primary air fan is on floor above

Kiln Firing

Kilns are fired by natural gas, with preheated secondary air and under induced draft, both exhausting at 425 deg. F. through a common reinforced concrete stack built by the Texas Chimney Co. after passage through dust hoppers on the pressure side of the fans. As stated earlier, there are two induced draft fans serving each kiln. Each of these Sturtevant fans has a rated capacity of 54,000 c.f.m. and is driven through V-belt by a 100-hp. motor. The main header from each kiln is divided into two headers leading to the fans and has manually-operated louvres just ahead of the division on the suction side so that the gas stream could be diverted to one fan in event of emergency. On the pressure side of the fans are automatically controlled louvres to regulate and maintain desired draft. Through Leeds & Northrup control, a single motor operates the louvres equally for both fans by means of a common shaft, to hold the draft at a figure set on the kiln firing instrument panel.

Kiln feed material is pumped from the kiln feed tanks into ferris wheel feeder tanks by 3-in. Morris slurry pumps. The overflow can return into either tank. Additional pumps permit the recirculation of slurry and transfer between tanks. A check on the volume of slurry fed is made daily by checkpot.



(1) Both kilns have emergency air motor drives (left one). (2) View toward feed ends of kilns. Ferris wheel feeders in back; dust return bin center. (3) Note how main exhaust gas header splits to dual draft fans for each kiln. (4) A pair of draft fans for one kiln. Note louvre to by-pass air from one of the fans, and adjustable fan louvres for draft regulation

Dust settled in the dust housing on the pressure side of the induced draft fans is conveyed by enclosed screw conveyors (2) to elevators and put in dust bins on the kiln feed floor. At intervals, this dust is fed into the kilns. A Rees Blowpipe Mfg. Co. dust feeder which regulates the rate of flow from each bin (2) is tied in electrically through a Reeves drive with the synchro-tie which keeps the rate of slurry feed proportional to kiln speed. Thus, the ratio of dust to slurry is held constant at all speeds of the kiln. If the alternator on the kiln drive should go out, a transfer is made to 440-volt current. Dust is conveyed by screw conveyor and fed into the vortex of slurry just below the ferris wheel feeder.

Firing

The kilns are fired by natural gas through Coen burners, which have variable air orifices that enable excellent control of flame through a mechanical interlock with the primary air flow. The burner tip is of stainless steel, 25 percent chrome-12 percent nickel alloy. Primary air is furnished by a Rees fan which can deliver 4500 c.f.m. at 30 in. of water. The mechanical tie between the 3-in. gas valve and 18-in. damper in the air line is positive means of maintaining a constant primary air-gas ratio. Natural gas available locally delivers 1000 B.t.u. per cu. ft. at 40 p.s.i.

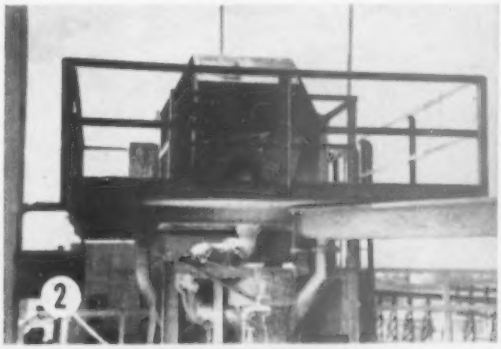
Clinker is burned at 2600-2700 deg. F. and discharged from each kiln over a 6- x 20-ft. Fuller inclined-grate clinker cooler. These coolers each have a 35,000 c.f.m. Sturtevant pressure fan to force cooling air up through the clinker bed and have considerable over-capacity in order to secure absolutely cooled clinker that may be placed directly into storage silos. The grates are run at the lowest possible speed for maximum cooling of clinker and thus cannot be varied automatically to regulate the temperature of the secondary air for kiln combustion which is preheated through the grate.

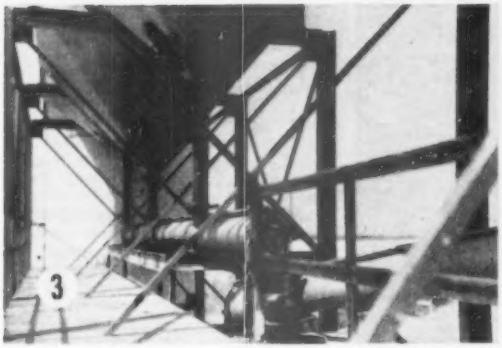
Combustion Control

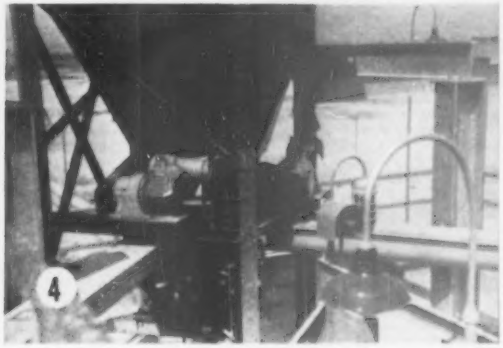
At an average production of 2000 bbl. per day per kiln, gas consumption averages 100,000 cu. ft. per hour at ambient. Total air volume is 1,000,000 cu. ft. per hour, consisting of 200,000 cu. ft. of primary air at ambient and 800,000 cu. ft. of secondary air preheated between 1200 and 1400 deg. F. Primary air consumption is 67 percent of the fan capacity. Kilns are operated to minimize any sudden changes in firing conditions in order to attain maximum production. The method of firing adopted is to hold the kiln speed constant and to vary the firing only when adjustments are necessary. Experience has been that, with kilns of this length requiring 3½ hr. for through travel, it is most desirable to hold the speed of kiln rotation, and its rate of feed, constant; otherwise a cycling phase would start as the operator is forced to adjust the rate of gas flow to compensate for variations in load that suddenly are presented. The accompanying typical gas flow charts bear out that maximum production can thus be achieved. They incidentally also show the influence of the human factor, it being the experience that when a burner starts his shift he immediately wants to change the rate of firing, or something.

Instrumentation

As stated earlier, these kilns are the most highly instrumentalized we have seen in our travels and, we might add, are more dependent upon instruments for performance than in most mills. It is desired to educate the burners away from the practice of firing by eye, and the type of instrument board designed and built for the purpose is proving effective by making the burner's work easier for him. The ready availability of service for the instruments is, of course, a factor in







(1) View at feed end of kiln, showing ferris wheel feeders overhead, slurry feed tanks, left, and header to stack at right. (2) One of ferris wheel feeders which has a drive synchronized with kiln drive. Note dust return screw conveyor on right. (3) Dust conveyor under housing to stack, returning dust for feed into kiln. (4) Dust from kiln breeching, conveyed into bin, is fed out for regulated return into kiln to maintain a constant ratio with slurry feed rate

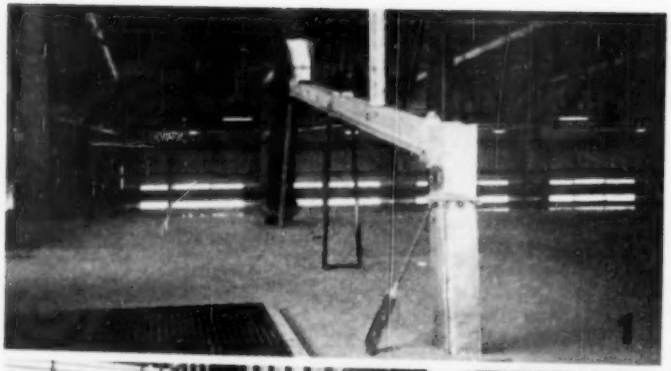
placing so much dependence upon them.

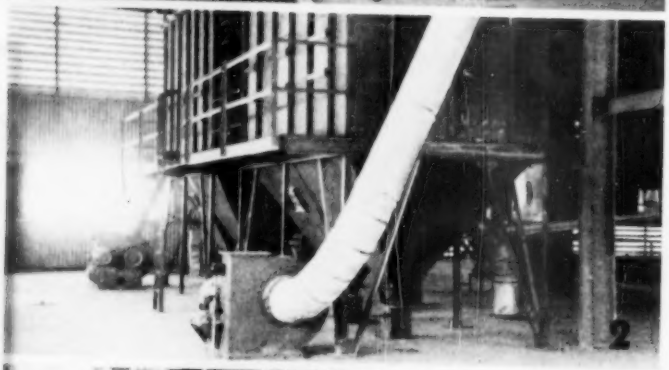
The kiln control board was designed by Works Manager A. J. Anderson and was built by Nelson Electric Manufacturing Co. of Tulsa, Okla. The engineering was done by A & H Electric Service Co. of Corpus Christi.

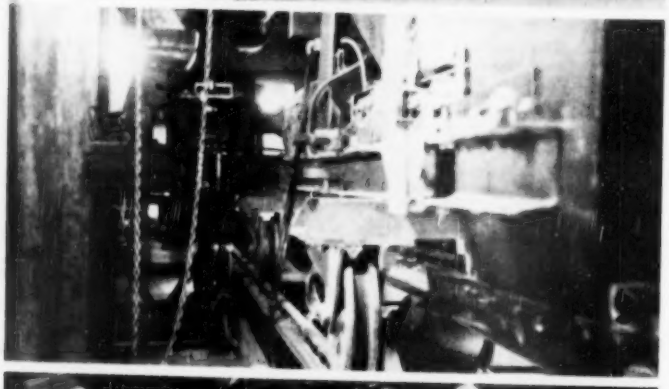
Three panels constitute the board. Those at each end have identical instruments for each kiln and the middle panel has instruments common to both kilns. Across the top is an illuminated flow diagram showing schematically all operations directly related to the kilns, including draft fans, the stack, the kiln, slurry feeder, the cooler and clinker handling conveyors right on through to storage. All the clinker handling drives, for drag conveyors, elevators and feeders are electrically interlocked.

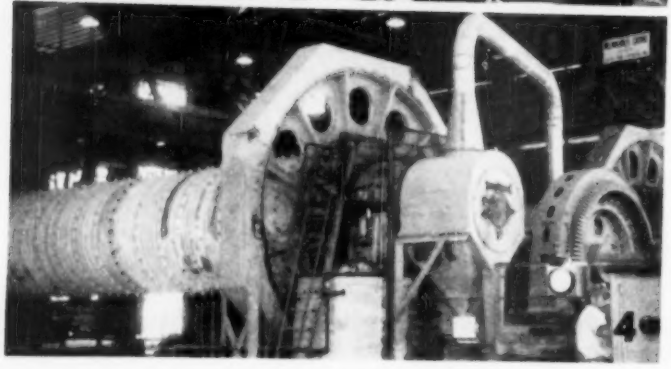
When all equipment is operating, the entire schematic flow diagram is lighted. Occurrence of a dark area indicates that some piece of equipment has stopped working and the operator can immediately tell what it is and where at a glance. The failure of feeders and other equipment of rela-

Left: Diesel engines (four) in power house. Right: Main switchboard in power house









tively minor nature will even be indicated by a blacked-out area. This visual check has been perfected to the degree that it will not only indicate whether or not a slurry feeder is working but whether or not it is receiving a supply of slurry and whether or not the material is getting into the kiln. Electric contacts and relays to the board are the means of illuminating each area on the flow diagram. Advantage is that time is important in quickly finding and correcting a trouble spot. The operators know that anything affecting operation of the kiln will show up and they depend upon the flow diagram.

Kiln Instruments

Principal instruments for each kiln include the following:

Foxboro Dynalog to indicate exit gas temperatures as measured by thermocouple at the back end of the kiln.

Micromax (Leeds & Northrup) for continuous recording of exit gas temperatures as measured by thermocouple.

Micromax for continuous recording of O_2 as determined by L & N continuous oxygen analyzer at the back end of the kiln.

Micromax continuous recorder for hot zone temperatures as measured by optical pyrometer at the hood focussed on the brick lining in the hot zone.

Micromax continuous recorder for CO_2 as determined by L & N analyzer at the back end of the kiln.

Brown continuous gas flow recorder.

Indicating instrument for draft at the hood and back end of the kiln and for the cooler stack.

Among other instruments are:

Ammeters for both kiln draft fan motors.

Ammeter for kiln drive motor.

Damper position indicator (percent).

Ferris wheel revolution counter.

Kiln speed indicator in seconds per revolution.

Kiln revolution counter.

Lights to indicate that ferris wheel feeder overflow is operating.

Manual wheel to change voltage of the kiln motor.

Switch for automatic or manual draft control.

In addition there are motor controls for the following:

Clinker drag conveyor over silos (10 hp.).

Cross clinker drag over silos (7½ hp.).

Silo elevator (25 hp.).

Clinker crusher (25 hp.).

Elevator to crusher (15 hp.).

LEFT —

(1) A view of airslide conveying cement from air separator. (2) Bag-type dust collector in finish mill grinding circuit. (3) Proportioning feeders for gypsum, left, and clinker to common belt into grinding mill. (4) Discharge end of finish mill, closed-circuited with air separator. Mill is water-cooled, has inching feature, and discharge temperature is indicated

Drag conveyor under cooler (1½ hp.).
Kiln draft fans (100 hp. each).
Kiln feeder.
Primary air fan (40 hp.).
Cooler fan (75 hp.).
Cooler grate.
Cooler stack fan (74 hp.).
Dust collector (10 hp.).

Between the two separate kiln panels, on the common panel, there is a clock, gas pressure indicator, and a recording instrument for gas temperature.

One of the important functions of the indicating instruments on draft is to prevent a negative pressure on the kiln hood. There is a Multiclone dust collector through which the Fuller cooler stack gases are passed which necessitates a positive pressure for operation. The fan for the dust collector is on the suction side of the collector. As a result, the kiln hood draft is held at +0.1 in. of water as closely as possible by control through the louvres on the stack fan. Draft at the back end of the kiln is maintained at —1.5 in. and at —0.1 in. in the cooler stack.

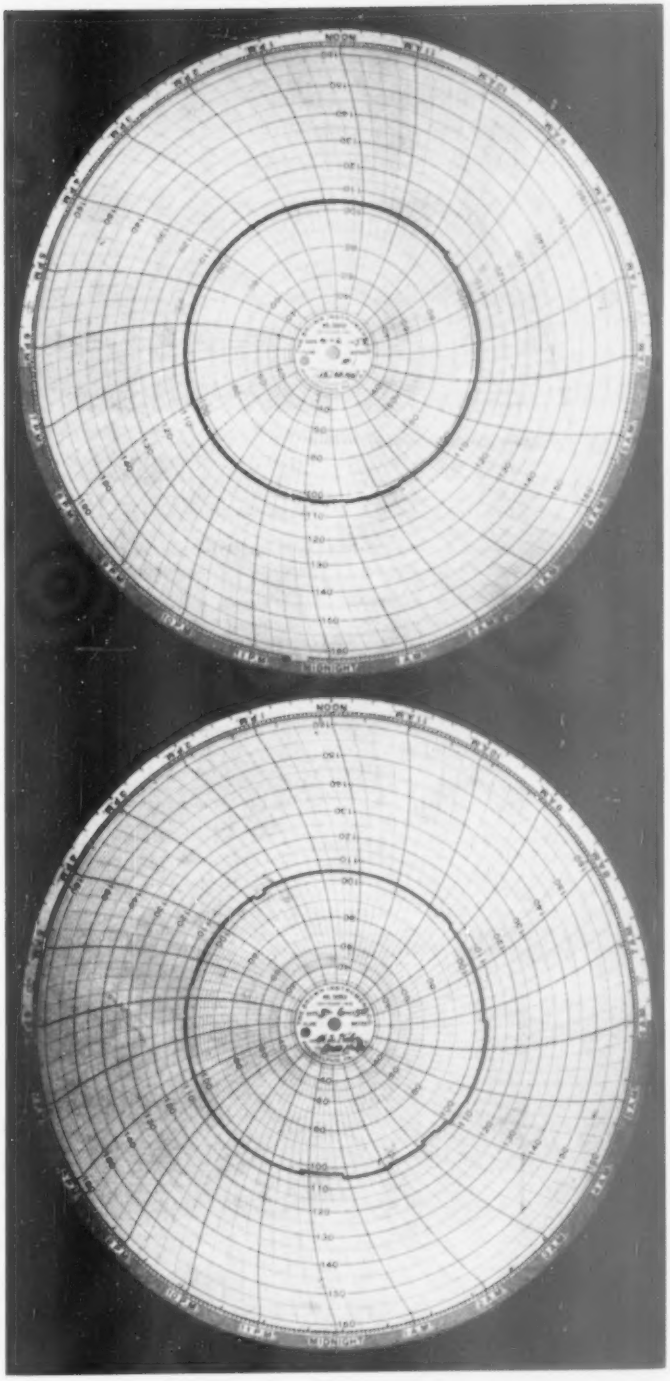
Draft Control

Through the L & N instrument controls, draft can be automatically controlled either through the kiln hood draft, back end draft or differential pressure. Normally, the back end draft is the means preferred for regulation. Draft can optionally be regulated manually. If the back end draft goes above the holding figure and the hood draft simultaneously drops, an obstruction is usually indicated in the form of a ring starting at the end of the calcining zone and at the beginning of the hot zone. Practice then is to move the flame back and drop the ring, which is usually successful. It is a simple matter to re-position the flame by varying the primary air flow. The primary air's most useful function is in order to hold the burning zone constantly where desired and to eliminate fluctuations and for ease in shifting the flame to drop rings as indicated by draft instruments. Due to the high moisture-content slurry, burning is presently with a rather long flame. A shorter flame will be used later when a higher solids slurry will be fed into the kilns.

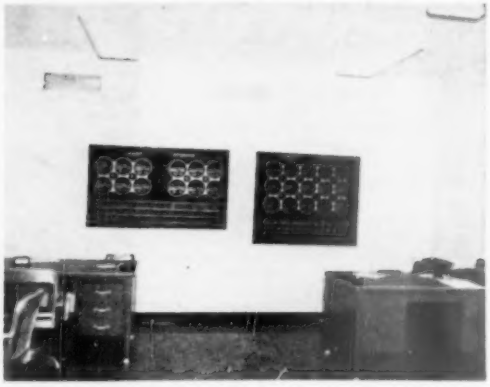
Free oxygen is held at about 3 percent, because of the excess water in the slurry. CO_2 is proportionately held at 18-20 percent. By continuously measuring and recording both CO_2 and O_2, an optimum ratio is expected to be established through draft regulation for best overall performance.

Among other controls, there are regularly spaced sample holes in the chain sections of the kilns for consistency measurements which are used to guide operation so that nodules of uniform size are formed which will reflect in uniform size of clinker. Incidentally, the clinker is remarkably uniform in size, measuring about ¼ in.

Free lime determinations, and



Gas flow charts for Kiln No. 1 (above) and Kiln No. 2 (below)



Left: Quality control office in laboratory. Right: Sample preparation room

analyses of percentage of solids and fineness of feed are made each hour.

At present, clinker is being produced with a heat consumption of 1,-200,000 B.t.u. per bbl. based on a production of 1900-2000 bbl. per day with a feed of 52 percent solids. This performance will be improved when the percentage of solids in the slurry is increased and when 6-in. brick are substituted for 9-in. brick in the hot zone.

Clinker Handling

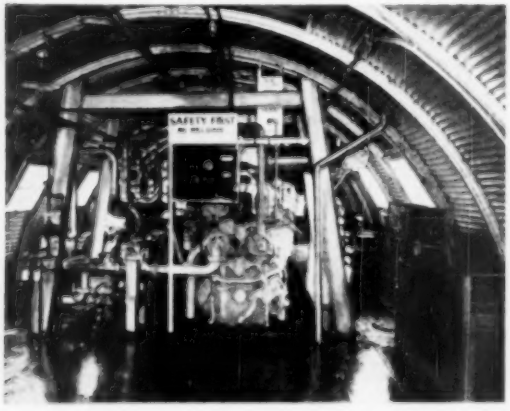
Clinker discharged from each cooler is elevated by a 54-ft. bucket elevator and put through a TY Traylor gyratory crusher for reduction of oversize, of which there is very little. It is then chuted to a drag conveyor which transfers to a bucket elevator to the top of the clinker silos where a cross drag conveyor and two parallel drag conveyors are the means of placing the clinker in any of ten silos. A Pangborn bag-type dust collector collects the dust from the crusher, elevators and drag chains, and the dust is discharged on the drag conveyor going to the silos. Cooler stack dust is similarly discharged onto a drag conveyor from the Multiclone collector.

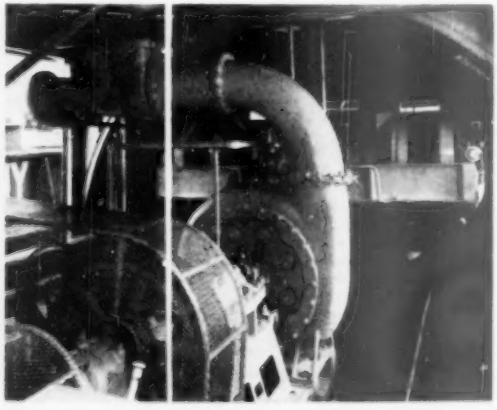
Clinker silos are arranged in two rows of five and have 45 deg. hoppered bottoms. They are 32 ft. inside diameter, 100 ft. in height and each holds 12,000 bbl. of clinker. Gypsum is received by rail alongside and elevated into a star bin. A 24-in. belt conveyor under each row of silos is the means of direct feed into each of two finish grinding mills. Three Schaffer Poidometers, rail-mounted, under each row of silos are available to feed clinker from one silo, or from several simultaneously, on to the belt. Gypsum is proportioned on to the same belt by a Jeffrey Waytrol through an interlock with the poidometers.

Clinker Grinding

Clinker is ground into cement by two 7- x 40-ft. Allis-Chalmers, 3-compartment mills driven by 750-hp. Electric Machinery Manufacturing Co. synchronous motors, which have the inching feature for charging grinding balls. Each mill is fed proportioned clinker and gypsum by belt conveyor from the clinker silos and is in closed-circuit with a 16-ft. Sturtevant mechanical air separator. Temporarily, the mill discharge temperature is being held to 215-220 deg. F. through the use of water sprays applied to the shell, in order to maintain high production. The mills roughly carry 6500 lb. of 3½-in. balls, 14,600 of 3-in. and 14,000 of 2-in. in the first compartment; 44,500 lb. of 1¼-in. in the second compartment; and 61,800 lb. of ⅞-in. Concavex media in the third compartment.

Mill discharge is conveyed by a 10-in. Fuller-Huron airslide to a bucket elevator from which it is chuted into the air separator. Cement is ground to 1800-1850 sq. cm./gm. at a rate of 120 bbl. per hour per mill. Rejects are returned into the feed end of the mill and the finished product, from both air separators, is transferred by airslides (2) into a cross 12-in. airslide which delivers to an 8-in. Fuller-Kinyon cement pump. A 200 percent circulating load is carried in the grinding circuit, with the capacity of the





Left: Inside pump room of dredge "Erle P. Halliburton." Right: Closeup of dredge pump

elevator the limiting factor. A Norblo bag-type dust collector vents the airslide and collects the dust from the elevator and mill discharge, discharging into the main airslide.

There are two Fuller-Kinyon cement pumps (one standby) each of which has a capacity of 450 bbl. per hour in pumping the cement into storage silos. They are driven by 150-hp. Electric Machinery Manufacturing Co. motors and are served by C-300 rotary compressors (2) driven by 200-hp. Electric Machinery Manufacturing Co. motors.

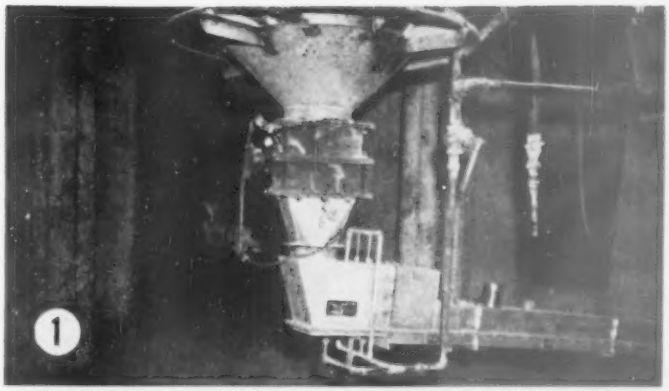
Packhouse

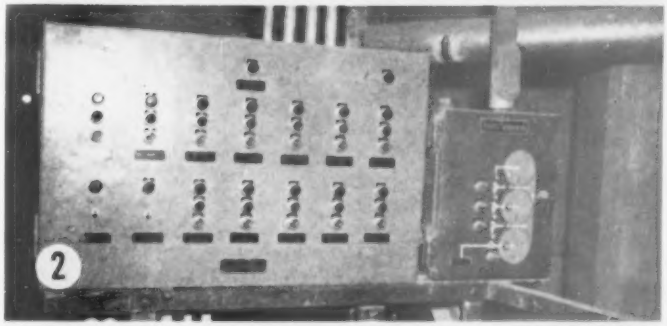
The packhouse and storage silos, shown in elevation (p. 123), provide for storage of 124,600 bbl. of cement and were designed to eliminate contamination in the handling of the various types of cement to be manufactured. Eventually, the mill will produce the five principal A.S.T.M. types of cement and high-temperature oil well cement.

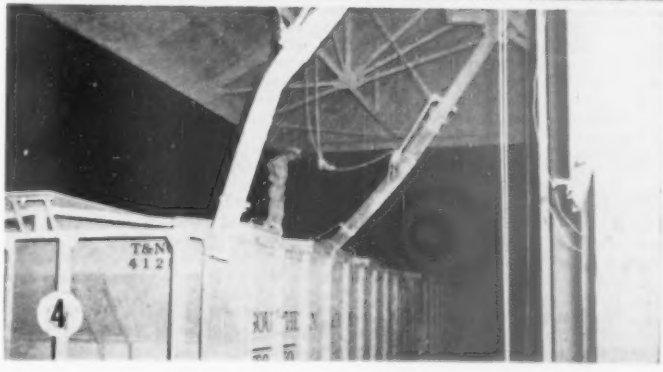
There are two parallel rows of six silos. The two at each end of a row measure 30 ft. in diameter and 67 ft. in height above the top of the hoppers, for a capacity of 12,000 bbl. each (8). There are four centrally located silos, each 30 ft. in diameter by 40 ft. in height and holding 7150 bbl. each. Under each is a 4-spout St. Regis packer of 200 bbl. per hour capacity. The bag storage building is centrally located and served by a service elevator. From the short silos, cement is delivered, in each case, by a Fuller-Huron airfeeder over a Tyler Hum-mer screen from which the cement drops into a 60-bbl. packing bin. Air to activate the feeder is controlled by mercoid switches on high and low Bindicators in the packer feed bin to maintain constant head.

Sacked cement is loaded out to cars on either side of the packhouse by a reversible 30-in. woven-wire conveyor. Spillage is chuted to an airslide and elevated to return over the screen or it may be pumped back into the silo in each case.

Cement from any of the large silos may be drawn to the packing machines, in which case airfeeders regulate the flow to airslides which deliver to the bucket elevator discharging over the Hum-mer screens. Also, cement from either of these silos may be conveyed by airslides to Fuller-Kinyon cement pumps (2) for delivery into ships or recirculation. Cement may be drawn from the short silos by airfeeders and airslides to the pumps for delivery into any of the tall silos or for ship delivery. High and low Bindicators at the pump hoppers are the means of regulation of air supply to







RIGHT —
(1) Air feeders under cement storage silos. Central feeders serve airslide to packer; upper right feeder is for airslide to 8-in. recirculating pump. (2) Packer control board including control and indicators for airslides. (3) General arrangement of packer. (4) Loading bulk cement into hoppered-bottom cars at packhouse

(1) Ellroy King, vice-president, secretary and treasurer. (2) H. R. Gingerich, chief chemist. (3) A. J. Anderson, works manager. (4) Erle P. Halliburton, Jr., vice-president. (5) Everett E. Knott, sales manager. (6) Keith Sandefer, chief engineer

the airfeeders which regulate the rate of flow. The loading of cars and barges and the sacking of cement can proceed simultaneously out of a single silo.

The foregoing merely points out the flexibility of the packing system. Details are clearly visible in the accompanying drawing.

Laboratory

The laboratory was designed by C. M. Price (recently deceased) who was widely known in the cement industry as an operating chemist and consultant, and is completely equipped for quality control and certain chemical research. It consists of a chemical control section for the testing of samples, a control section for the determination of alkali content, $CaCO_3$, free lime, etc., and a physical testing section.

Among the more important control tests regularly run are free lime determinations every 2 hr., surface area tests every hr. and autoclave soundness tests each day, SO_3 determinations each hr. and solids determinations from the bowl slurry overflow and thickener underflow each hour.

Power

Electrical power for all plant operations is generated by Fairbanks-Morse generating sets consisting of two 2000-hp. natural gas-oil engines driving 1400 kw., 3-phase, 80 percent power factor generators and two 1600-hp. similar engines driving 1125 kw. generators of similar characteristics to the larger ones. Current is generated at 4160 volts. Full load of the plant requires 5600 hp., leaving a 1600-hp. engine as standby.

Personnel

Officers and operating executives include Erle P. Halliburton, president; Erle P. Halliburton, Jr., vice-president; Ellroy King, vice-president, secretary, and treasurer; R. A. Beaver, assistant secretary and assistant treasurer; A. J. Anderson, works manager; Everett E. Knott, sales manager; Keith Sandefer, chief engineer; and H. R. Gingerich, chief chemist.

Erle P. Halliburton is a widely known industrialist and is probably best known as having started the oil well cementing process that was an

important factor in revolutionizing the oil business. His oil well cementing company has more than 4000 employes and is operated out of Duncan, Okla. Mr. Halliburton is the holder of many patents covering the cementing of oil wells. Among his other interests, he is in the aluminum luggage business and operates a gold mine in Honduras. He is a native of Tennessee and served in the Navy during World War I. His main interest in cement has, in the past, been as a large user of cement. His wife, Vida C. Halliburton, is actively interested in all his enterprises.

Erle P. Halliburton, Jr., is a newcomer to the cement industry and has, until recently, been actively engaged in the various Halliburton enterprises. A graduate of the University of California, he served in the Army and was discharged in 1946 as a captain. He is an aviation enthusiast with more than 900 hr. flying time in the air and pilots a company plane in the interests of the business.

Ellroy King's past experience has been largely in the oil-well cementing field, having been with the Halliburton interests for many years.

A. J. Anderson, works manager, has been engaged in cement manufacture since his graduation from the University of Nevada and needs no introduction to the industry. Before the war, he was installation engineer and later superintendent of the Permanente Cement Co. plant. Following service in the Marine Corps during the war, he built three cement plants for General American Transportation Co. in the Orient. These plants were finished and placed into operation before being taken over by the Chinese communists.

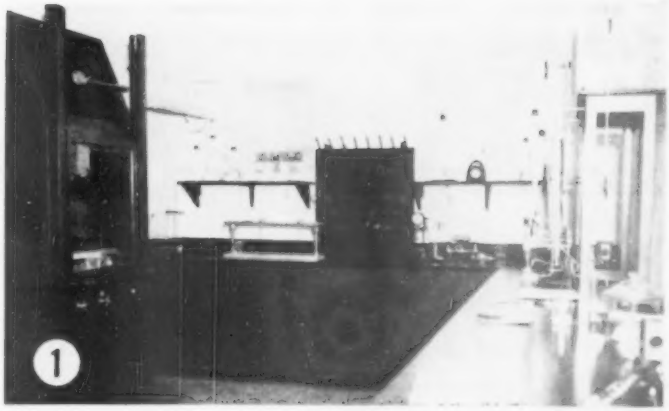
Everett E. Knott, sales manager, started his cement career in 1928 as a territory salesman for Lone Star Cement Corp. and through successive promotions became sales manager for his territory which was in Texas.

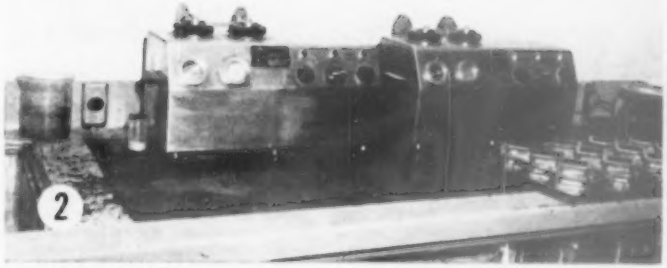
Keith Sandefer, chief engineer, served as an engineer during construction of the plant and stayed on with the company when construction was completed.

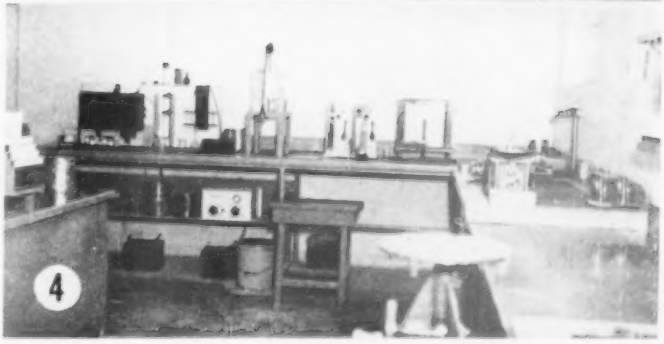
H. R. Gingerich's past experience was with Standard Portland Cement Co., Painesville, Ohio, in production and as chemist with Medusa Portland Cement Co. at York, Penn.

R. O. Bartholomew, now chief engineer of Carolina Giant Cement Co., was consulting engineer, and Macdonald Engineering Co. handled the construction engineering.

In closing, we wish to acknowledge the extremely cordial reception and cooperation we enjoyed during our visit to Corpus Christi, by all the officers and by members of the staff in supplying data and photographs and drawings used for illustration in this article.







RIGHT —
(1) Mix laboratory. (2) Consistometer used for testing consistency of oil-well cements. (3) Analytical laboratory. (4) Physical testing laboratory

Grinding in Closed Circuit With Air Classifiers

Lehigh's $4,000,000 program at Fordwick, Va., also comprises new kiln, storage facilities, waste-heat boiler, masonry cement mill, in addition to new raw mill. Capacity increased by 1600 bbl. per day

By BROR NORDBERG

A MAJOR PROJECT in Lehigh Portland Cement's Co.'s postwar rehabilitation and expansion program, totalling in excess of $19,000,000 capital investment through the year 1949, has been completed at the Fordwick, Va., mill. The program at Fordwick has involved the expenditure of $4,000,000.

Built originally in the early 1890's, the plant was operated by the old Virginia Portland Cement Co. before purchase in 1915 by Lehigh. There had been some modernization since that time but the recently completed program was necessary to bring the mill completely up to date. Also, its capacity has been increased from 3200 bbl. to 4800 bbl. per day, to a rating of 1,600,000 bbl. annually.

The mill is a dry process, waste heat operation. It is located on the C & O railroad and produces standard portland cement, air-entraining cement, mortar cement and A.S.T.M. types II and III. The plant is wired for 25-cycle electricity and, accordingly, is operated to generate its entire power requirements.

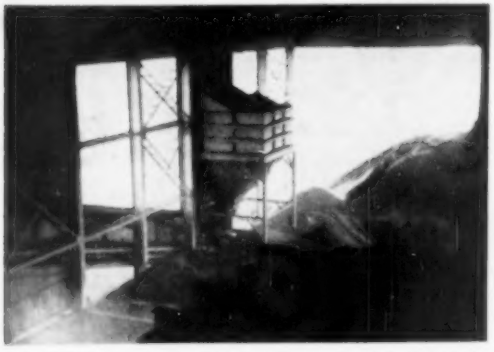
Expansion of capacity by 1600 bbl. per day has resulted from addition of an 11- x 200-ft. rotary kiln with a waste heat boiler and air-quenching clinker cooler. Finish mill capacity was already sufficient for the increased clinker production, so that department was unaffected by the enlarged production. It had been modernized some ten years ago when mechanical air separators were installed for closed-circuit grinding of cement.

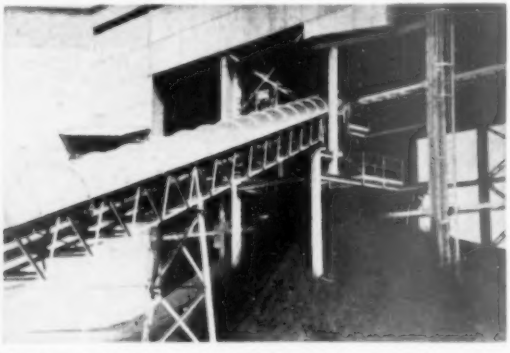
Raw mill grinding capacity had to be stepped up and inefficient practices eliminated, so an entirely new raw mill department was built. Equipment of the old raw mill has been adapted to the manufacture of mortar cement, and this still is housed in the old raw mill building separate from the portland cement grinding department, thus increasing the overall capacity for grinding finished products.

Increased storage capacities for raw materials and clinker, and much more flexibility and efficiency in material handling, were accomplished by replacing the old storage areas with a single covered storage area served by two overhead, traveling cranes. Alongside the new material storage building, a completely new crushing and screening plant for limestone and shale was built. The packhouse, storage for finished cement and quarry operations were adequate and unaffected by the program. The accompanying drawing shows the mill in plan, upon completion of the rehabilitation and expansion.

Firing Methods

Among the developments of greatest interest are the direct-firing of coal into the rotary kilns by air-swept tube mills. The practice of firing kilns with individual tube mills is used in a few plants, so it is not new to the portland cement industry but, at Fordwick, the hookup whereby six kilns are fired by three coal-grinding tube mills is unique. A single mill direct-fires the new 11- x 200-ft. rotary kiln, an identical mill fires two 9- x 125-ft. kilns and a third fires three 7-ft. 6-in. x 125-ft. kilns. Heated air is drawn from the hood of the new kiln (No. 6) to dry the coal as ground, according to conventional practice in firing with unit mills, but in the case of the 9-ft. kilns (Nos. 4 and 5) and the smaller





Left: Within storage area, coal from hopper is carried by belt to kiln firing department. Right: Coal is handled by belt from railroad car hopper into storage. Some equipment transports other materials received by rail for transfer into bins

kilns (Nos. 1, 2 and 3), a stoker-fired furnace supplies heated air to be swept through both mills to dry the coal as it is being ground.

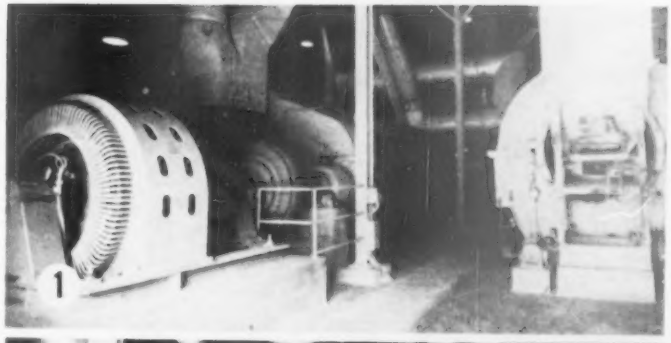
Two similar mills, but of larger capacity and with two compartments, are closed-circuited with air classifiers instead of the conventional mechanical air separators in the new raw grinding department. They replace a two-stage system of a preliminary roller-type mill followed by tube mills which were closed-circuited with mechanical air separators. Since the mills are air-swept by furnace-heated air while grinding, the use of separate dryers has been eliminated.

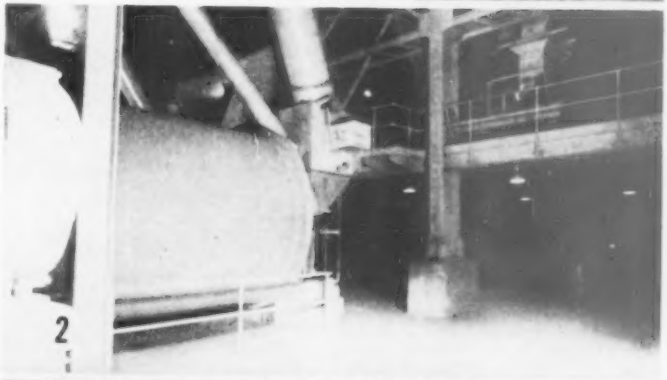
Lehigh is using air-swept mills of this type to considerable extent in its overall rebuilding and enlargement program, with a view toward decreasing maintenance costs while accomplishing favorable operating efficiency. The company completed a somewhat similar raw grinding system at its Metaline Falls, Wash., plant early in 1949 and is providing for air-swept mills in the raw grinding department at the Mason City, Iowa, plant which is now being completely revamped.

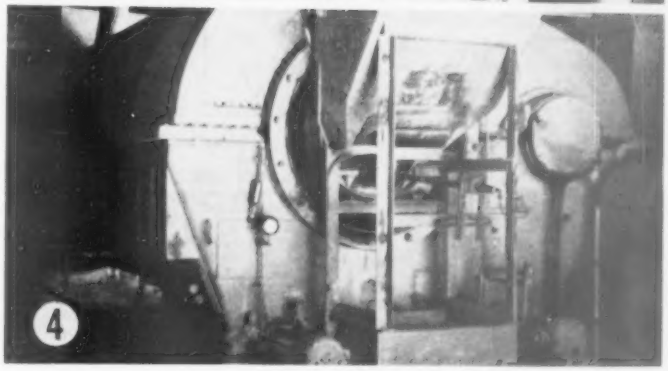
Also of interest is the use of bag-type unit dust collectors throughout the new and rebuilt sections of the plant, each installed at the point of origin of dust, to return the dust into the system. There are 11 new Norblo collectors so installed. Three, in the crushing plant, serve the primary breaker, the cone crusher, and sizing screens, respectively. Others are provided for the raw mill (2), the new clinker grinding mill in connection with the manufacture of masonry cement, at the proportioning feeders in the raw mill and at various points of dust generation in the handling of clinker and raw materials.

Quarry Operations

Limestone is quarried at a location three miles, by rail, from the crushing and screening plant. Excavation is by two 54-B Bucyrus-Erie 2-cu. yd. electric shovels loading into end-dump trucks for transfer into Easton side-dump quarry cars which are hauled in trains to the primary crusher. The terrain and length of haul dictate the use of rail transportation, but the flexibility of truck operation within the quarry has justified a combined operation. Trains averaging 18 cars, with 12 tons of stone per car, are hauled over standard-gauge rail by either of two 65-ton Whitcomb diesel-electric locomotives. Shale is hauled by rail from a quarry close to the plant.







RIGHT —

(1) View of raw mill setup, showing drive with magnetic clutch on left, for one mill. Note main hot air header in background. (2) Feed end of one of raw mills, with feed proportioning equipment upper right. (3) View of a mill circuit, showing exhauster fan and circulating air piping to mills, which is insulated. (4) Discharge end of raw mill, showing drive, and piping from exhauster in background. Note mill level controller pipe at center of mill

Stone and shale are rail hauled to plant from separate quarries

Crushing Plant

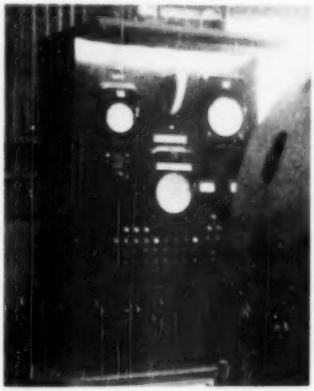
As shown on the accompanying drawing (Fig. 1), stone is crushed and screened in a flow paralleling the new covered storage area and for discharge of limestone into a stone pit for rehandling by overhead crane into the main storage area. Shale is similarly handled.

Location of the primary 36-in. McCully gyratory crusher has not been changed, it being the only unit retained from the old crushing-screening plant. However, the jaws have been opened up for greater output and the belt conveyors for handling stone throughout are 30-in. width where they were 24 in. before. Dumping of quarry cars has been mechanized and is done electrically through a hook operated by push button. A 6-in. minus product from the primary is conveyed to a vibrating grizzly just over a 7-ft. Symons standard cone crusher which is driven from a 250-hp. motor. Another belt conveyor splits the cone product and by-passed stone, over two Symons vibratory horizontal screens in parallel. Plus ¾-in. stone is returned to the cone crusher by belt conveyor and the throughs are elevated by belt conveyor for discharge into the stone pit. Shale is processed separately through the same equipment and then placed in three 700-ton bins. The grizzly and the belt conveyors including all the new ones throughout the plant are of Kennedy manufacture.

Storage Facilities

Covered storage for limestone, shale, clinker, gypsum, coal and pyrite (for type II cement) are under a single roof 500 ft. in length with a clear span of 80 ft. in the main storage area. It is served by two Shaw-Box overhead traveling cranes with 3-cu. yd. buckets which can extend their travel over the coal mill grinding building to handle heavy milling equipment. Live storage bins within the area, for the various materials, are serviced by the overhead cranes.

At the end nearest the kilns, where clinker is discharged by drag conveyor into a clinker pit, storage is provided for 33,000 bbl. of clinker and, in addition, for 5000 bbl. of high early strength cement clinker. Conveniently adjacent are an 88-ton clinker bin and one of 65 tons capacity for gypsum, from which interlocked Shaffer poidometers proportion the flow to a 14-in. belt conveyor for delivery to the masonry cement plant in the old raw mill building.



Control board for operation of air-swept grinding mill pulverizing raw material

Shale storage, an area set aside for sand storage, another clinker live storage bin and a pulverized mortar-stone bin are between the main clinker storage area and the stone storage area, which has a capacity of 5600 tons. Then follows in order, to the far end of the covered storage area, gypsum storage for 1100 tons with a gypsum bin of 93 tons adjacent, pyrite storage for 500 tons and a coal storage area for 9700 tons. Clinker for the finish grinding department is conveyed from the aforementioned bin by 24-in. belt conveyor to a 129-ton clinker bin adjacent to the gypsum bin. Here, the two materials are proportioned by interlocked Shaffer poidometers to a 24-in. belt conveyor delivering to the finish mill building.

In connection with the new storage facilities, new handling equipment was constructed for rail-delivered materials including coal, gypsum and pyrites. These materials are delivered in hoppered-bottom cars on a railroad trestle, from which they are unloaded into a hopper. A pan feeder regulates flow to a 24-in. inclined belt conveyor which discharges, in handling coal, into the coal storage area. When handling gypsum or pyrites, the belt transfers to a second belt from which a swinging spout is the means of discharge either into the gypsum storage area or that for pyrites. A Robins car shaker is operated at the rail discharge hopper to clean out the cars. Coal is transferred into a 90-ton bin from which a Jeffrey vibrating feeder regulates the flow to a 24-in. belt conveyor delivering to the kiln and cooler building where the coal is placed in the respective mill feed bins by drag conveyors.

Raw Mill

The new raw mill building is adjacent to the stone storage section of the undercover storage area where seven feed bins are arranged in a row. Each of the raw grinding mills draws its feed from a stone bin (88 tons), a shale bin (65 tons) and a pyrite bin (65 tons). The seventh bin (32 tons) supplies coal for the stoker firing the hot air furnace which supplies heated air to be swept through the grinding mills.

These feed bins have steep sloping hoppers and the feed from each of the three bins serving a mill is regulated by a Shaffer poidometer. These feeders are wired in series to maintain a predetermined proportion of the separate raw materials fed into the mill. A similar hookup of the proportioning

Showing transfer from air classifiers to cyclones in raw grinding circuit. There are two classifiers and four cyclones per mill

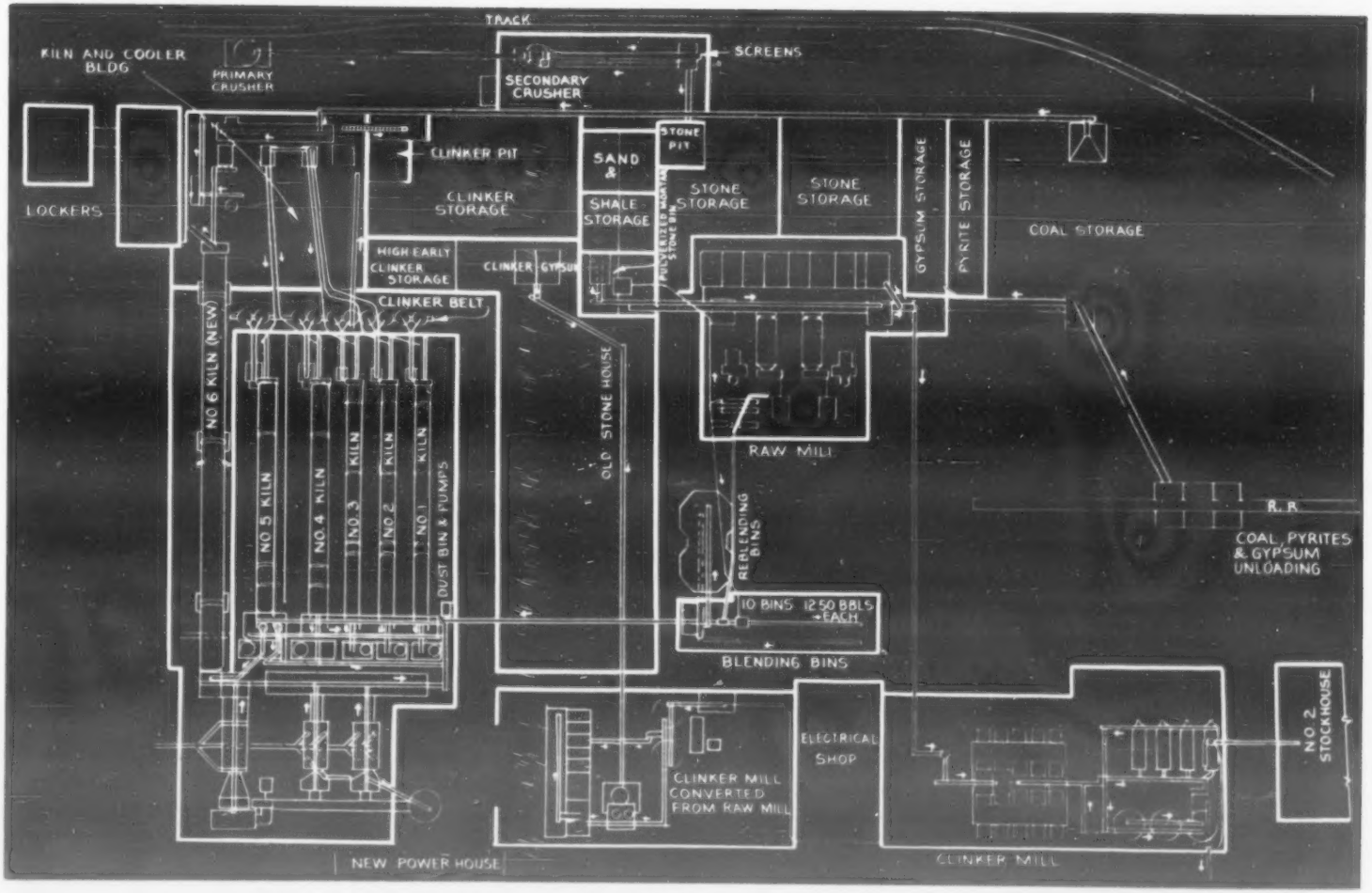
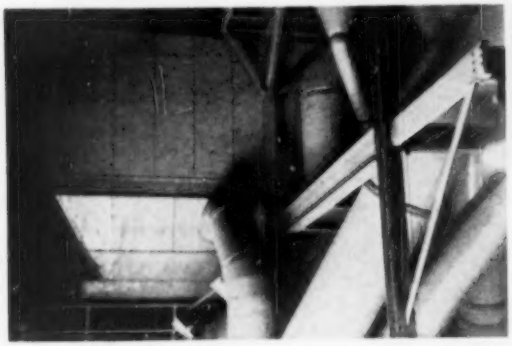
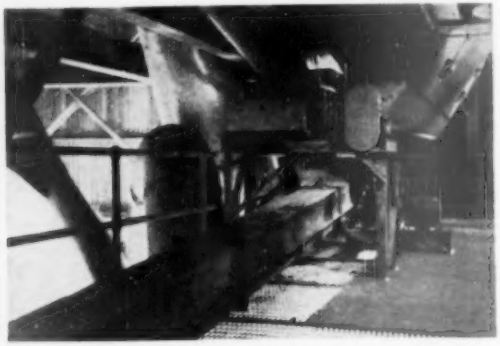


Fig. 1: New 11- x 200-ft. rotary kiln added to Lehigh Portland Cement Co.'s Fordwick, Va. plant is visible in this plan view at left





Left: Overhead bag-type dust collector in raw grinding circuit. Right: Material from cyclones in grinding circuit and from dust collector are transported by airslide for elevation into blending bins

feeders for clinker and gypsum, previously mentioned, accurately regulates the ratio of each.

Grinding Mills

Grinding of raw materials is accomplished to a fineness of 91 percent minus 200-mesh (94 percent for type III cement) through two separate Kennedy (KVS) grinding circuits. Each circuit consists of a 10- x 22-ft. air-swept, integral-gear-driven tube mill, through which heated air is swept carrying the mill product to overhead air classifiers, where the size split is made and from which rejects are returned into the feed end of the mill. Heated air is supplied both circuits from a hot air furnace fired by an Iron Fireman stoker. The mills have a short preliminary compartment carrying a charge of 2- and 3-in. forged steel grinding balls followed by a longer finishing compartment carrying 2- and 1¼-in. grinding balls. They are driven at 18.4 r.p.m. by 900-hp. Electric Machinery Mfg. Co. low-starting torque synchronous motors through Cutler-Hammer magnetic clutches, the gears in the speed reducers integral with the mills being two-stage herringbone gears and pinions. The shell of each mill is insulated against heat loss with 2 in. of mineral wool which is metal encased, and all piping in the system is insulated with asbestos covering. The exhauster is driven by a 200-hp., 750 r.p.m. synchronous (Electric Machinery Mfg. Co.) motor through flexible coupling; the fan rating is 40,000 c.f.m. measured at 190 deg. F., which is the exit temperature maintained out of the mill.

Heated air drawn through the mill carrying pulverized material is split, in each of the two systems, to enter through the bottom of two 9-ft. 6-in. radial flow classifiers where a separation is made at the desired fineness. Rejects are released through a 10- x 18-in. rotary air lock into a spout for return to the feed end of the mill and the air stream carrying the fines from each classifier is drawn in parallel through two 5-ft. cyclones. The product settled in the cyclones is discharged through 10- x 18-in. rotary air locks into a 12-in. F-H airslide which delivers into a bucket elevator from which screw conveyors fill the blending bins.

The air in the system is cleaned through a size 25 Norblo bag-type dust arrestor and material from the dust collector discharges into the same airslide carrying the cyclone product.

Operation of Mill

The mill flow and the various control features are best understood by referring to the accompanying flow diagram (Fig. 2). Raw material as proportioned by the interlocked poidometers enters the mill at A through a gravity trap which is counterweighted so that the weight of material and the suction in the feed box open the trap sufficiently to permit passage of material while restricting inrush of cold air. At B, rejects from the classifiers enter the feed box to enter the mill, mixed with fresh feed material. Recirculated air enters the feed box through pipe D while fresh air from the hot air furnace enters through pipe C.

At the discharge end of the mill, additional air may be added through F, to supplement the carrying capacity of the air from the mill through dampers J or G. At present, this supplemental source of air is not required.

Pipe E conveys the air and material from the mill discharge to the two radial flow classifiers which operate in parallel. It is in the classifiers that product size is controllable through several adjustments. The vertical rods L regulate the throat opening, which is closed down in order to obtain a finer product. Conversely, it is opened up when a coarser product is desired. Rods M adjust a circular baffle, or annular ring, up or down. The lower it is set, the finer the product that will result. Damper N permits entry of air into the reclassifying zone. The more air admitted

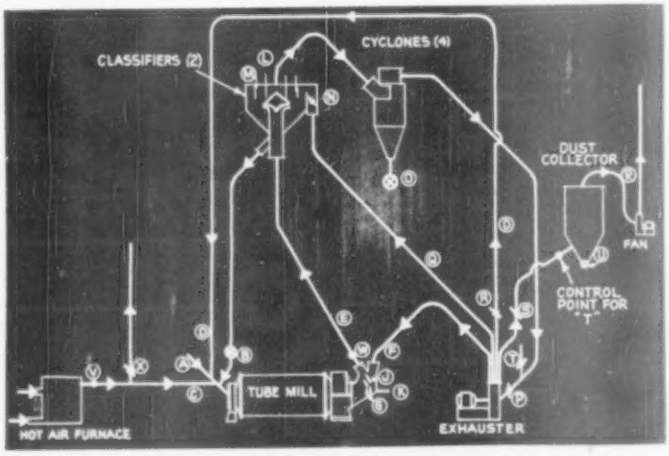


Fig. 2: Flowsheet of raw grinding mill

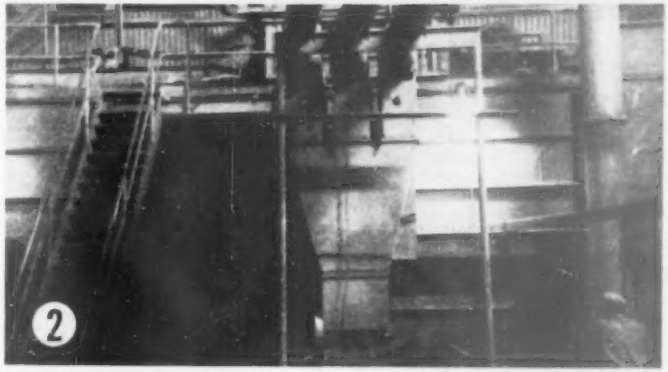
through this damper, the coarser the product will be, and the returns as rejects will decrease.

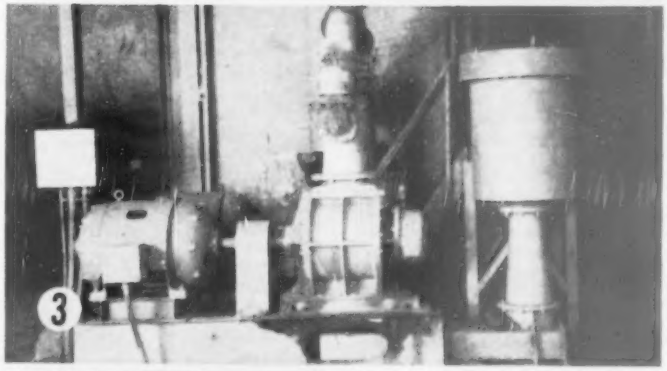
Finished product separated from the carrying air in the four cyclones in each circuit is discharged through rotary valve O to the airslide and the air is returned through piping and damper P to the exhauster.

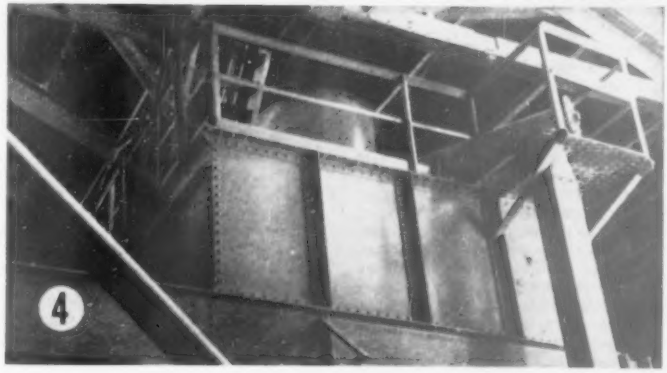
There are four discharge branches from the exhauster. One is designed to carry by-pass air through piping F into the discharge from the mill and is not now in use. The second branch line carries reclassifying air through Q to dampers N into the classifiers and is particularly important in the control of size of product. A third branch carries recirculating air through damper R and pipe D to the feed box of the mill, and the fourth vents air through damper S and through the air filter. Fines collected in the air filter are discharged into the finished raw material airslide. Quantity of air vented from the air filter equals the quantity entering through the fresh air inlet C plus leakage.

There is automatic compensation to take care of variations in the moisture content of the raw materials. When the amount of moisture increases, hot air introduced is proportionately increased, variations in moisture reflecting in the temperature of the air leaving the mill as measured by a recording thermometer (W) at the discharge end of the mill. If this temperature drops because of increased moisture, damper S in the vent line automatically opens wider so that more air is put through the air filter, which increases the suction so that more heated air is pulled from the furnace through pipe C.

The stoker on the hot air furnace is adjusted manually to maintain a certain firing rate. Gases from the fuel bed are tempered by cold air admitted through openings in the furnace, which has a control thermometer at the furnace discharge (V) to maintain a constant temperature range. At the low point of this set range, the stoker automatically starts and it cuts out at the high temperature. The range set is for a differential of 40 deg. F. For average moisture content in the raw material, air is drawn through the mill at approximately 400 deg. F. from the furnace, to hold an exit temperature established at 190 deg. F. A thermocouple at the mill outlet is the means of holding this temperature constant through automatic adjustment by air valve of the previously mentioned air damper S. Should the mills be stopped for any short interval of time, the heated air from the furnace is vented through a







RIGHT —

(1) Note split in coal-air line for firing two kilns from one unit mill. (2) Three-way split for coal-air stream in firing three kilns from one mill. (3) Raw material is fed into two rotary kilns by airlift. Shown here is compressor installation. (4) Top of airlift where feed enters screw conveyor for transfer to kiln feed pipes

Instrument board for new kiln operation

stack rather than stop the furnace.

Feed into the mill is regulated through the KVS automatic mill level control. The pickup tube, or feeler pipe, is introduced through the discharge box opening K and is pointed downward close to the ball level in the mill. Through a photo-electric relay reacting on a liquid level manometer tube connected to the feeler tube, speed of the poidometer feeders is regulated to hold a constant desired level in the discharge end of the mill. The poidometers are driven by 560-750 r.p.m. motors and operate at full speed or half speed or may automatically stop until the mill load adjusts to the desired level. The poidometers regulate flow, as proportioned through interlocking, on to a common belt discharging through chute A.

Letter T on the flow diagram is a safety control which opens a cold air damper at inlet to the fan if the air temperature approaches 200 deg. F., as a safeguard against burning the air filter bags.

Fineness of product leaving the mill depends upon the air current passing through, which is measured by a mill differential gauge. Damper P is adjusted to maintain the established differential gauge reading. When moisture in the raw material increases, the air current must be increased to maintain a certain fineness of product because of the increased water vapor introduced in the system.

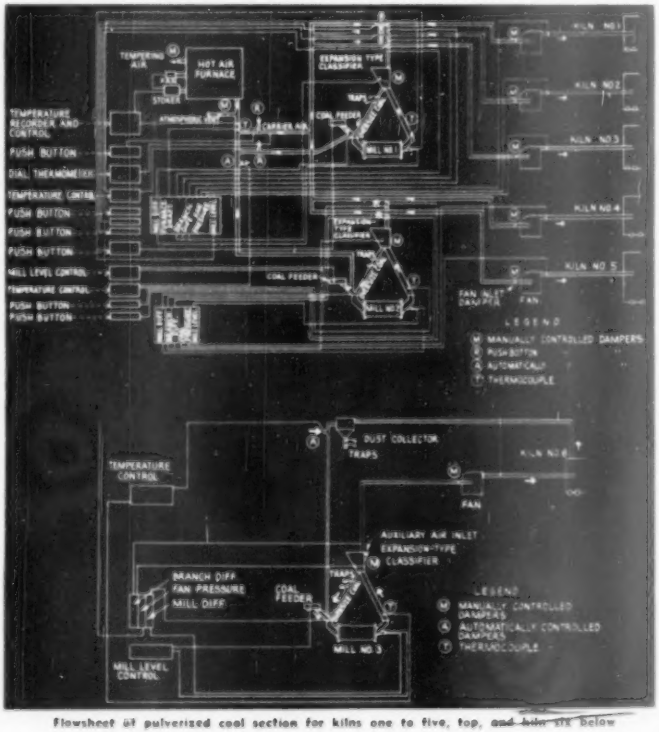
The grinding circuits were designed to handle 137,000 lb. per hr. of air, plus water entering the exhauster, or a volume of 40,000 c.f.m. at 190 deg. F., and to carry a 350 percent circulating load of 20-mesh maximum size material. This figure is based on a ball loading of 123,000 lb. per mill and a production of 37½ t.p.h., Hardgrove grindability index 65, for a feed size of 85-90 percent minus ½-in. A circuit was designed to grind raw material at 6.18 kw.-hr. per bbl. (610 lb.). However, the mills are presently being operated to produce 34-35 t.p.h. each with a reduced ball loading of 95,000 lb., drawing 180-190 amps. on the mill drive motors as compared to 224 amps.

Pressure on the fan is 13 in. w.g., totaling 2½ in. through the mill, 4 in. for the classifiers, 2 in. for the cyclones, 4 in. for piping and dampers, and 1½ in. for the hot air supply. Coal consumption in the furnace is 1400 lb. per hr. of coal with an average heat value of 13,500 B.t.u. per lb. as delivered. The fan motor is drawing 40 amps. against 46 amps. at full capacity.

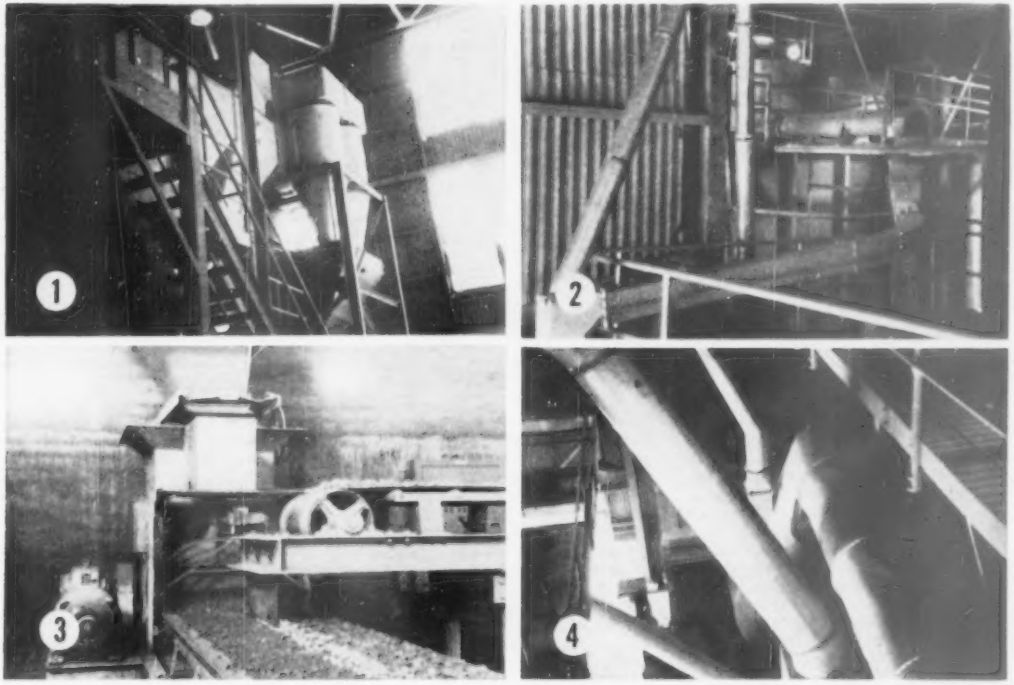
Each grinding circuit has an independent KVS instrument panel board. Among the principal instruments are a Hays single pointer draft gauge which indicates the mill differential pressure, a Bristol recording thermometer and air-operated proportion controller (also indicating), Bristol dust collector temperature indicator, Bristol recording thermometer for the mill discharge, mill motor kilowatt meter, ammeters for the mill exhaust fan motor and dust arrestor motor, and indicating lights for all related equipment. The hot-air furnace has a Hays single-pointer draft gauge, Bristol indicating and recording pyrometer controller, switches, etc., on a separate instrument panel.

Blending

Raw material is conveyed to the blending bins by the previously mentioned 12-in. airslide and is elevated and put in the bins by screw conveyors. This part of the plant operation has been unchanged. There are ten 1250-bbl. blending bins and two reblending bins of 2000-bbl. capacity each. Star feeders are the means of withdrawal, and elevators and screw conveyors are used for transfer between blending bins and to the kiln feed bins. Kilns 1, 2, 3 and 4 are fed by conventional screw conveyors from individual bins into the feed spouts. A single bin serves kiln No. 5 and the new kiln (No. 6) where feed regulation is through Fuller airlifts. Feed into No. 5 kiln is by conventional screw conveyor to the feed spout from the airlift and, for No. 6 kiln, the



Flowsheet of pulverized coal section for kilns one to five, top, and kiln six below



(1) Cyclone-type dust collector following waste-heat boilers. (2) Two kilns are fed raw material from one airlift. Note airslide for transfer to feed spout of one of kilns. (3) Showing how gypsum and clinker are proportioned through feeder scales which are interlocked. (4) Steam header from hot air furnace

transfer of regulated feed is accomplished by an airslide discharging into the feed pipe.

New Kiln

Clinker production has been increased by 1600 bbl. per day since kiln No. 6, an 11- x 200-ft. Smidth unit, with individual B & W waste heat boiler, economizer and Buell cyclone dust collector, went into production. The kiln has a slope of ¾ in. to the foot, rides on water-cooled rollers, and is driven by a 100-hp. variable speed Allis-Chalmers slip ring motor through a Philadelphia gear with a speed range of 60-110 r.p.h. It is lined with 9-in. 70 percent alumina brick in the hot zone, and 6-in. brick from 70 percent down to 42 percent alumina for the balance of its length. Rate of feed into the kiln is regulated through a synchro-tie with the kiln drive motor. The kiln exhausts at 1600 deg. F. entering the dust housing ahead of the waste heat boiler and the gas temperature at the boiler intake is 1400 deg. F. The boiler output is 27,000 to 35,000 lb. of steam per hr., at 190-200 p.s.i. gauge and 485 deg. F.

Exhaust temperature after passage through the boiler, economizer and dust collector (under suction) at the point of exhaust into the stack, which serves all the kilns, is 350 deg. F. The draft fan has an air-operated Bailey louvre damper controller automatically adjusted to maintain the desired draft at the rear end of the kiln. The kiln is direct-fired by pulverized coal from a unit air-swept tube mill and it discharges over a Fuller inclined-grate clinker cooler which is the source of preheated secondary air for combustion. The kiln has a Hercules gas-engine for standby, to turn it over in case of power failure.

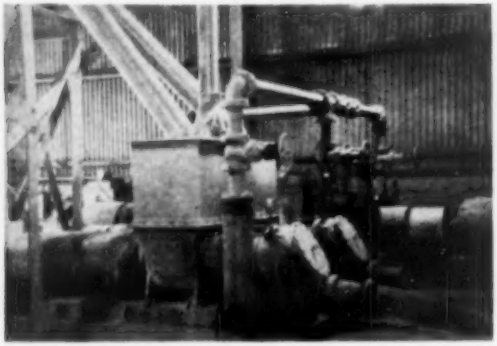
Firing is regulated by varying the kiln speed while holding the firing conditions constant, and firing is controlled from an FLS centralized instrument panel. Approximately one-third of the total waste heat power (25 cycle) generated in the plant is supplied from the new kiln-boiler unit. The average power generated is 5000 kw. from a 2500 kw. G.E. generator and one of 2500 kw. rating. The mill is self-sufficient in power through regulation of peak power requirements department by department.

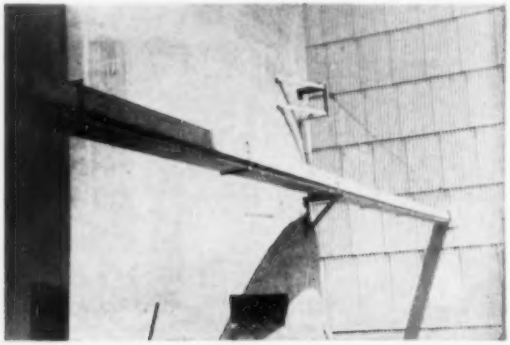
Firing by Tube Mills

All six kilns are direct-fired by air-swept, coal-grinding tube mills of the same type of construction and manufacture as the raw mills except that they are 7- x 9-ft. mills and have no division into compartments. A single mill fires the large kiln (No. 6), a second fires both the 9- x 125-ft. kilns by a system of dividing the stream from an expansion-type classifier, and the stream of pulverized coal mixed with primary air is divided in three ways to fire the 7-ft. 6-in. x 125-ft. kilns.

Primary air in the case of kiln No. 6 is withdrawn from the kiln hood, put through a clinker dust cyclone and tempered with cold air before sweeping through the mill, whereas a hot-air furnace fired by an Iron Fireman stoker supplies the heated air for drying the coal as it is pulverized through the other two mills. In each case the mill is fed coal from an overhead bin by a 42-in. enclosed disc feeder and plow. The feeder is slowed or stopped or speeded up as actuated by the KVS mill level control to hold the desired loading in the mill. The expansion type classifiers (3) have adjustable deflector blades which divert the large particles away from the outlet, and these rejects are returned into the feed end of the mill. Individual blowers inject the coal-air mixture from the classifiers into the kilns through horizontal water-cooled burner pipes with alloy-tipped burners which are adjustable.

Quantity of coal swept out of a mill to the classifier depends upon the





Left: Cement pumps for transporting ground limestone (for mortar cement) into storage. Right: Raw grind is conveyed by airslide to elevator filling storage bins

velocity of the air through the mill, which is regulated by damper. Velocity in the horizontal pipe is maintained at about 4000 f.p.m., and additional air is admitted into the system through an auxiliary air inlet at the classifier, as needed, to increase velocity.

When there is more than one outlet, as in the case of two of the mill circuits, additional adjustable deflectors in the classifier correct the coal-air distribution for equal air flow to the various branch lines. With the deflector in fixed position, the proportion of coal is varied by changing the air flow to the branch outlets. Pressure drop of the air flow through the branch outlets is indicated on differential draft gauges which guide the operator in adjusting the air flow. By changing the air flow through one outlet, the air flow through the mill is altered, so it is necessary to make compensating adjustments in the other branch outlets. This is done through the operator comparing readings of the mill differential gauges and with the outlet gauges.

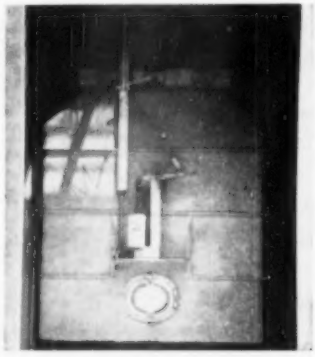
Heated primary air swept through each mill is maintained automatically at about 500 deg. F., for a normal coal moisture of 7 to 8 percent, in order to hold a mill outlet temperature of 180 deg. F. An electric-driven tempering damper in the hot air line coming from the clinker dust trap is actuated by a thermocouple at the mill outlet, for kiln No. 6, and, for the other circuits, temperature is maintained by automatic tempering dampers in the hot air line from the furnace.

The stoker for the air-heating furnace, supplying air swept through the two mill circuits for kilns 1-5, is controlled automatically to hold a temperature within the range of 580-620 deg. F. and there are manually operated tempering air inlets at the furnace to adjust the control range. Heated air is supplied the two mills through a split in the main header.

In addition, carrier air is taken off the main header and introduced at the inlet side of the two classifiers from which kilns 1-5 are supplied coal. Its temperature is maintained at 180 deg. F. by damper control at the classifier. The firing circuits for all the kilns are shown schematically on the accompanying drawings.

Each mill is driven at 22 r.p.m. by a 150-hp. Electric Machinery Manufacturing Co. electric motor through a Falk flexible coupling, and the ball loading is principally of 2- and 1½-in. forged steel balls. The exhauster for kiln No. 6 is driven through a similar coupling by a 50-hp. motor. Exhauster fans for kilns 1, 2 and 3 are driven by 20-hp. motors and, for kilns 4 and 5, by 25-hp. motors. The kilns are fired by a short hot flame (2700 deg. F.) under a pressure of 2-in. w.g.

Automatic features are Leeds & Northrup tempering damper control mechanisms consisting of indicating controllers, thermocouple and motor-operated drive mechanism. Hays indicating draft gauges (3 pointer) measure exhaust outlet pressure, orifice differential and mill differential pressure for each circuit. All operations are centralized at separate instrument panels. Direct-firing tube mills were selected on the basis of anticipated low maintenance costs and because of their flexibility in pulverizing coal that may vary widely in moisture content. Moisture averages 7-8 percent, but the coal could be pulverized successfully if the moisture content were two or three times as great. Coal averages 13,500 B.t.u. as delivered, crushed to ¼-in. minus.



Automatic draft fan louvre damper is air-operated

Mortar Cement

Equipment from the old raw mill has been adapted to the manufacture of mortar cement in the old raw mill building. Clinker and gypsum as proportioned by poidometers from bins within the covered storage area are conveyed by belt to a Bradley preliminary mill. Product from this mill is carried by screw conveyor to an elevator from which tube mill feed bins are filled. Mortar limestone, pulverized through the raw mill to 70-72 percent minus 200-mesh, is proportioned with the clinker and gypsum by addition into the screw conveyor carrying the preliminary mill product. This stone is withdrawn from its storage bin and transferred into a 6-in. F-K pump by airslides for transport into a bin in the mortar plant where an airlift regulates the rate of feed into the preliminary mill stream.

Final grind is through five Smidth tube mills in closed circuit with two Sturtevant mechanical air separators.

Finish Grind-Storage

Finish grinding is accomplished through ten Griffin preliminary mills followed by grinding through four tube mills in closed circuit with two 14-ft. mechanical air separators. Total storage capacity is 244,000 bbl. of cement in three stockhouses.

H. F. Shellenberger is plant manager and J. C. Kyle is chemist. Roy N. Young is vice-president and operating manager, and W. M. Harbaugh is chief engineer, both with headquarters at the company's main offices in Allentown, Penn.

This picture was taken in the quarry serving the new Skanska Cement Co. plant at Stora Vika, Sweden

Skanska's Newest Long Kiln Plant

IN THE EARLY PART OF 1949, Skanska Cement Co.'s new plant at Stora Vika started to operate with an estimated yearly capacity of 1,750,000 bbl. It was built to take care of the increasing demand for cement in Sweden, which had made it necessary to import considerable quantities during the previous three or four years.

The building site was selected at a limestone deposit right on the shore of the Baltic Sea, where suitable clay was also found. The location is also favorable for economical transportation by water of fuel and gypsum rock to the plant and bulk cement to the nearby city of Stockholm. Cement storage silos and a packhouse have been erected at the latter city.

The limestone is a hard, crystalline rock which has been penetrated with

Left: M/S Vika I arriving at distributing station in city of Stockholm

Right: Office and laboratory

General view of new plant of Skanska Cement Co., which has a yearly capacity of 1,750,000 bbl.

Located at the quarry are picking tables, the secondary crusher, surge bins, and the loading station for the aerial tramway

dolomites and other non-usable rock. The rock is blasted and loaded with 2½-cu. yd. electric shovels onto Euclid semi-trailers. The primary crushing is done in a 48-in. x 72-in. jaw crusher, from where it goes on a system of conveyors and picking tables to the secondary crusher. The dolomitic rock is dark colored and easily discernible among the white pieces of limestone, greatly facilitating hand picking. The waste is removed from the picking table and shunted off to a commercial stone plant. The limestone is transported on a fully automatic 800 yard long funicular aerial tramway. Each bucket takes about 3000 lb. load and travels 500 f.p.m.

Raw Material Grinding

The aerial tramway discharges the limestone either to an emergency stockpile or into the storage building. A belt conveyor in this building can take the rock directly to the mill bins if desired. The building is 910 ft. long and has two traveling cranes each with 115-ft. span and 11-ton capacity. They are equipped with clamshell buckets and handle limestone, coal, clinker and gypsum in the building. The rock in the emergency pile is taken into the building by bulldozer when needed. The limerock is fed from the mill bins to the primary raw mills by weighing feeders. The water is fed into the mills at the same point.

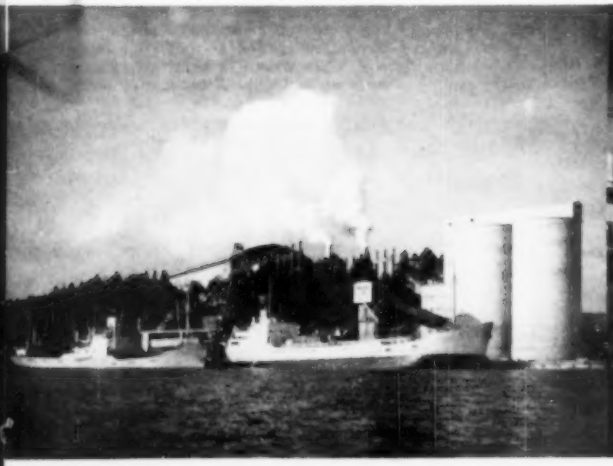
The mills are in closed circuit with rake classifiers. An auxiliary mill is used for grinding sandstone, bauxite and other material as may be needed. The slurry from the primary mills is either pumped to centrifugal separators in the flotation room, preparatory to beneficiation, when needed, or directly to thickeners. From thickeners it goes to the pug mills where clay and the product from the auxiliary mill is added. The slurry is now ready for the finish raw mills, and after grinding it is pumped to slurry silos for final chemical correction. From here it is emptied out into a slurry basin with nearly 7000-cu. yd. capacity.

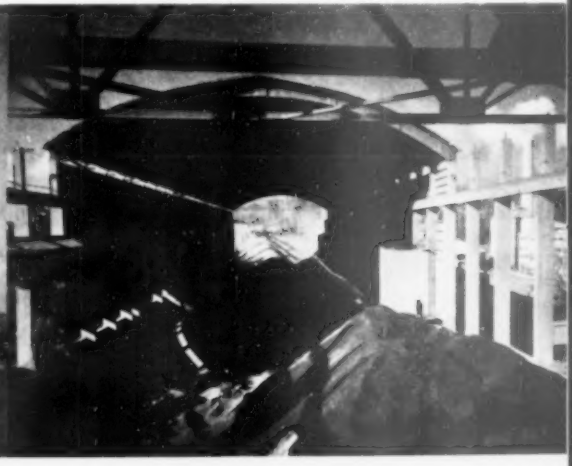
Calcining

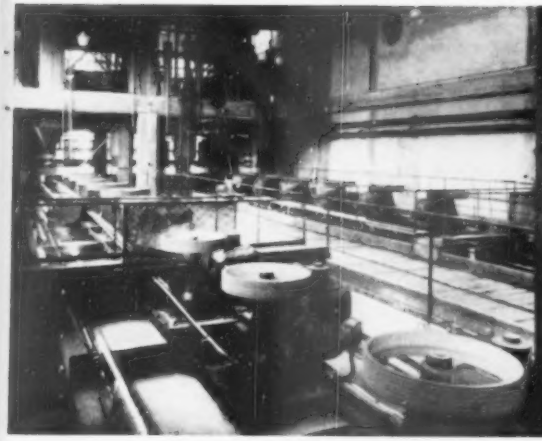
The two kilns, 475 ft. long and 12 ft. in diameter with planetary coolers, were manufactured by F. L. Smidth & Co. They are equipped with slurry dryers, chain system and quadrants for fuel economy and produce upwards of 5500 bbl. a day. The kilns are placed inside a building with roof and sides covered with asbestos-cement sheeting as a protection against severe freezing weather. The clinker is conveyed to the storage building on a drag chain conveyor, passing a crusher on the way.

The M S Vika I loading at the cement plant

Storage building of Skanska Cement Co.







View of flotation room

Firing end of kilns showing planetary coolers

Finish Grinding

The mill building is located adjoining the storage building with the mill feed bins inside the latter. The material to be ground is put in the mill bins by the grabs and fed to the mills by "Pendan" feeders—short conveyors for proportioning and weighing the mill feed. The cement grinding mills are 8 x 10 ft. with internal water cooling of the material. The motor driving the mill is rated at 1050 hp.

Distribution

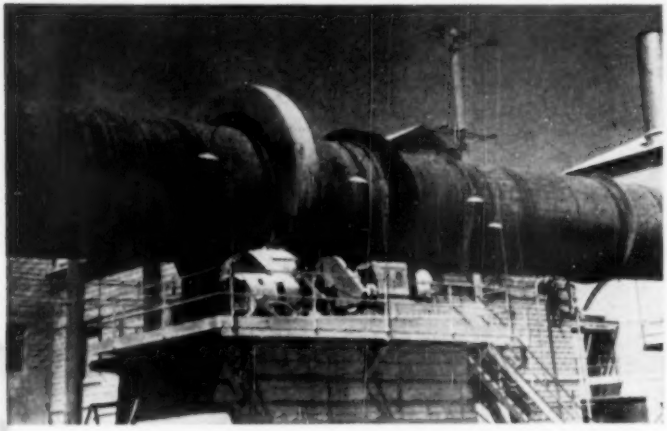
There is only a small packhouse at the plant, for most of the cement is shipped in bulk by water to Stockholm, where a packhouse and storage silos, adequate for the demand, are located. Stockholm is the capital of Sweden and has a strong building activity. It is figured that the cement delivered from this plant will take care of that market. Due to favorable location at the Baltic Sea, the M/S *Vika I* makes five trips between the plant and Stockholm each week with a pay load of about 1700 tons. The loading and unloading is fully automatic, a system of conveyors and elevators taking cement out of the ship's hold and another system of conveyors distributing the cement when loading. All conveyors run in dusttight enclosures and only one telescoping spout has to be connected for the operation.

Plant Layout

The drawing to right shows the plant layout of Skanska Cement Co. Numbers are keyed to the following list.

1. Funicular aerial tramway
2. Receiving tower for aerial tramway
3. Conveyor for limestone
4. Raw material storage
5. Stockpile of limestone for emergency
6. Primary raw mills
7. Auxiliary grinding mill
8. Cement mills
9. Compressor room
10. Pipe line duct
11. Flotation room
12. Thickeners
13. Secondary raw mills
14. Pug mills
15. Clay storage
16. Slurry silos
17. Slurry basin
18. Rotary kilns
19. Coal mills
20. Clinker conveyors
21. Belt conveyor for coal
22. Cement silos
23. Packhouse
24. Conveyor for bulk cement to ship
25. Freighter
26. Gantry crane with clamshell for coal and gypsum
27. Storehouse
28-31. Steel belt conveyors
32. Traveling bridge cranes with clamshells
33. Repair shop
34. Carpenter shop and boiler room
35. Locker room
36. Office and laboratory
37. Lunch room
38. Rooming house
39. Main transformer station
40. Water pump house
41. Water surge tower
42. Car scale

Plan view of plant; numbers refer to equipment list above



Closeup of kiln drive which is synchronized with kiln feed

Auxiliary boiler in connection with new kiln-boiler installation at The Monarch Cement Co. mill meets peak requirements for turbines so kiln can produce clinker at low fuel cost per bbl.

By BROR NORDBERG

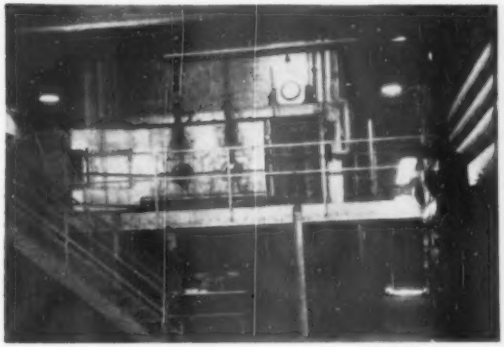
Waste Heat Power With Maximum Kiln Efficiency

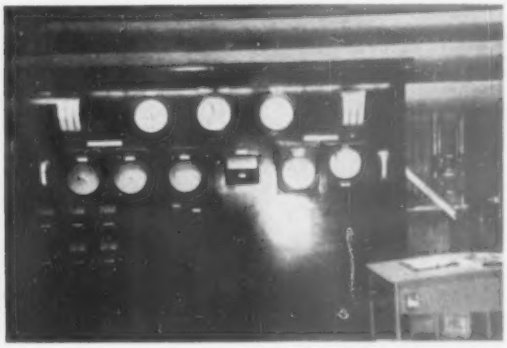
THE LONG-STANDING CONTROVERSY in the portland cement industry as to the relative value of long rotary kilns which exhaust at low exit gas temperatures, as compared to shorter kilns with waste heat boilers and power generating plants persists, and installations of both types continue to be made. There is much to be said for both schools of thought but it is a rare case indeed when a fair comparison can be made, because conditions are dissimilar at different plants, and because wide fluctuations in the costs of major equipment have great effect in measuring the economics of an installation. At today's prices for boilers and power plants, it is doubtful that new waste heat boilers and a new power plant could be justified for an entirely new dry process plant unless the cost of purchased power happens to be somewhat higher than the average charge over the country today.

However, in existing plants which already have power plants, such new installations sometimes are justified economically in order to avoid purchasing any power. There have been several such installations in recent years and some of them have not been too successful. Unforeseen power demands actually have rendered obsolete, in fact, new installations because of inadequate power, and the operators have found it still necessary to resort to careful balancing of power demand against waste heat power production. And there is no reserve in event of needed installation of additional power-consuming equipment in the future.

One of the most recent rotary kiln installations with waste heat boiler has been completed by The Monarch Cement Co. at Humboldt, Kan., which had an existing power plant and found it necessary to modernize its operations to reduce costs. This installation is interesting and unique because it was designed to make the plant self-sufficient in its ability to generate its entire power requirements and with plenty of reserve through auxiliary boiler equipment that enables the kiln to be operated efficiently in the production of cement clinker.

View of kiln looking toward firing end





Left: Auxiliary boiler for makeup, as needed, to augment waste-heat boilers. Unit has great over-capacity and generates steam quickly. Right: Instrument board for boiler operation

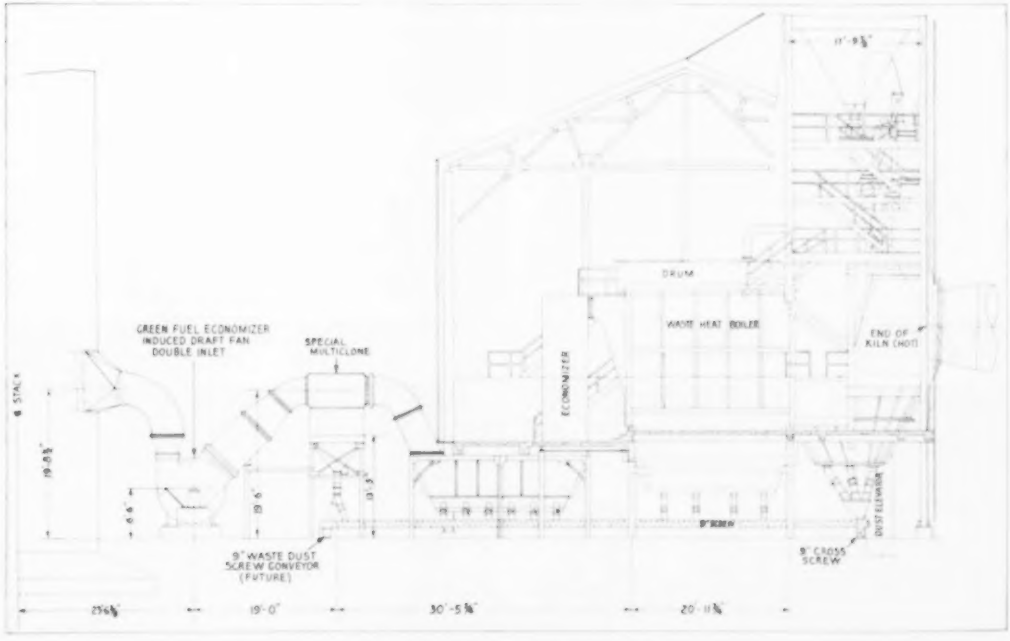
Monarch has operated short kilns in connection with waste heat boilers for many years. It still operates from four to seven 8- x 125-ft. kilns hooked to individual waste heat boilers and has experienced the shortcomings so common to all of the older waste heat plants.

These short kilns have proven, like others in the industry, to be very inefficient. Fuel consumption and the amount of waste heat were so high that all the power requirements of the plant were being generated from waste heat but it resulted in the need for continuing grinding operations around the clock and strict attention to the balancing of power demand against waste heat production.

Auxiliary Boiler Permits Kiln Efficiency

At Monarch, it was decided that a waste heat plant would be more flexible and efficient if installed in connection with an efficient dry process kiln which would provide much less heat for power purposes than could be made available with a shorter and less efficient kiln. Burning fuel in a separately fired boiler was considered preferable to accomplishing the same end through burning extra fuel in the kiln, in order to attain flexibility and enable controlling the kiln operation to achieve good burning conditions in the manufacture of cement clinker.

After much consideration as to the proper kiln dimensions, with a view to balancing production of clinker against ability to generate steam from waste heat, it was determined to install two 11- x 230-ft. rotary kilns, each to exhaust at 1400 deg. F. into a waste heat boiler. This installation was calculated to produce only enough steam to generate 80 percent of the power requirements of the plant, and an amply-sized direct-fired auxiliary boiler was therefore indicated to pro-



Sectional elevation of new boiler room building

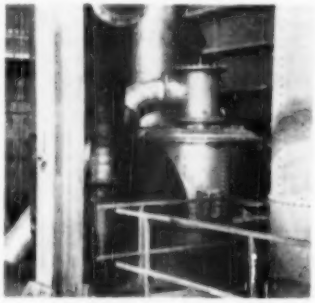
Interior of power plant, showing waste-heat boiler on left

vide the balance of the required power with plenty of reserve for peak demands, as well as standby replacement capacity if either of the waste heat boilers should be idle.

Initially, only one kiln and waste heat boiler were installed, together with the auxiliary boiler.

The kiln was designed for a heat consumption of 1,050,000 B.t.u. per bbl. of clinker. Heat recovery in the waste heat boiler, with design exit gas temperature of 385 deg. F., was calculated at 340,000 B.t.u. per bbl. which in terms of steam, will generate about 18 kw.-hr. of power per bbl. This leaves about 5 kw.-hr. per bbl. as the requirement to be met by the auxiliary boiler. The kiln is being operated strictly as a cement kiln, independent of the demands for waste heat, and it is up to the power plant to utilize the steam and temperatures supplied, making any deficiency from the auxiliary boiler and dumping any excess.

This installation was started in June, 1948, not to increase cement manufacturing capacity, but because the mill is 40 years old and it was necessary to achieve more efficiency and reduced costs. For practical purposes, purchased electric power is unavailable to the mill. The older kilns, still in operation, are inefficient and have no modern control features. The long-range program provides for the installation of the second 11- x 270-ft. kiln with waste heat boiler during the coming winter alongside the one described herein, which will exhaust also to the 10- x 300-ft. concrete stack that serves the present new kiln. Then, the two waste heat boilers will carry the entire plant load for 16 hr. a day and the auxiliary will be required only during the 8-hr. peak load when the quarry and all other departments are operating. The new kiln is fired by natural gas and exhausts to the boiler. Then follows an economizer and cyclone dust collector on the suction side of a variable-speed induced draft fan, and exhaust through the 300-ft. stack. The kiln is operated in connection with an air-quenching, grate-type clinker cooler and has a number of automatic controls through a centralized kiln control board. Instrument control of draft conditions, for the purpose of uniformity of kiln operation, is also of utmost importance to control of power generation.



Direct-firing bowl mill for service if gas supply is cut off

New Kiln

The kiln is of Allis-Chalmers manufacture, of welded construction and rides on four sets of water-cooled rollers. It has a slope of ¾ in. to the foot, an air-cooled nose ring and the discharge end is sealed at the housing to prevent air leakage. Natural gas is the commonly used fuel, fired at a pressure of 40-42 p.s.i. through a water-cooled burner pipe. The burner pipe is mounted on dead center of the kiln but so that it can be directed at any angle to re-position the flame. Firing is with a short, intense flame with a 2700 deg. F. temperature maintained in the hot zone.

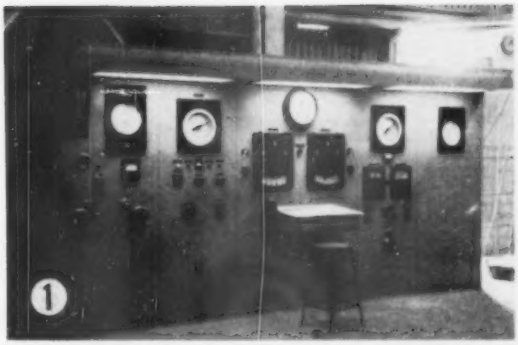
Lining is with 6-in. refractory brick throughout the length of the kiln. The first 20 ft. of length from the nose ring is lined with a dense fire clay brick with special abrasion-resisting properties. The next 40 ft., which is the hot zone, carries 70 percent alumina brick, followed by 20 ft. of 60 percent alumina brick and, then, 40 percent brick to the backend of the kiln.

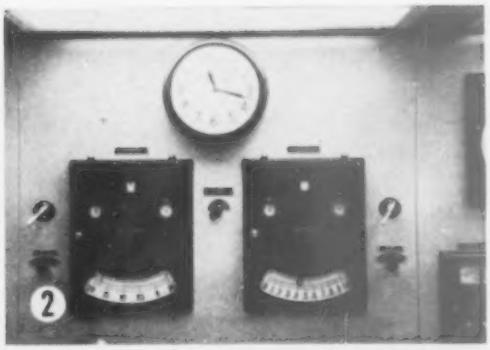
The drive has an Allis-Chalmers synchro-tie to synchronize rate of kiln

(Continued on page 210)

RIGHT —
(1) Instrument board for firing new kiln. (2) Indicating draft gauges, for hood and back end, for new kiln. (3) Feeder for kiln feed is driven through synchronous tie off of kiln drive. (4) Nose ring is air cooled as shown. (5) View of hood, showing natural gas burning pipe. Clinker trap on right is in connection with coal mill firing. (6) Exhaust end of new kiln, showing dust collector on left and fan to stack. (7) Air-quenching clinker cooler. (8) Blast fan for clinker cooler, showing adjustable louvre-damper

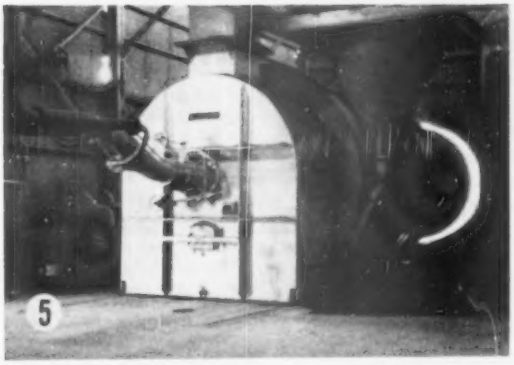
Plan view of plant and new kiln installation


1


2

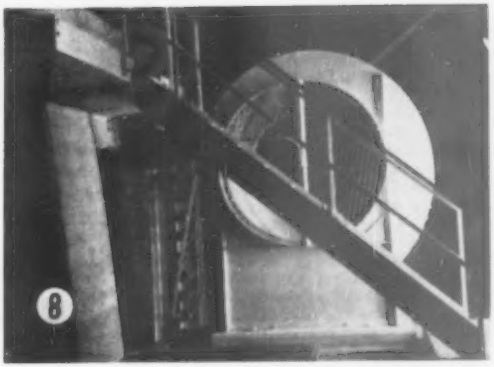

3


4


5


6


7


8

Aerial view of Cebu Portland Cement Co. plant in the Philippine Islands

Doubles Production of Cement To Meet Demands in Philippines

By EDUARDO TAYLOR*

AT A COST OF $3,000,000 the Cebu Portland Cement Co. in the Philippines has recently completed an expansion program that was designed to make the Republic self-sufficient in its cement requirements. Heretofore, this country, which has a population of 19,000,000 people, had to import considerable quantities of portland cement from other countries to the detriment of its dollar reserves.

The Cebu Portland Cement Co. is the largest of the only two cement plants in the Philippines. It was established in 1922 as a single unit plant with one kiln (10 x 11 x 175 ft.) and with an output of 1000 bbl. daily. This production was gradually increased to 1400 bbl. per day. Among additions were slurry filters, a direct-firing coal pulverizer, a clinker cooler, and an air separator. Later a complete duplicate unit was added, bringing the capacity up to 2800 bbl. per day. This was prior to the war. In each of the years 1940 and 1941, the plant produced slightly over 1,000,000 bbl. of portland cement.

*General Manager, Cebu Portland Cement Co., Manila, Philippine Islands.

Then came the fateful years of Japanese occupation. Manila was overrun by the Japanese hordes in January, 1942, and the head office of this company was immediately seized. The island of Cebu, where the plant is located, was invaded in April of the same year. The Japanese military captured the plant and turned it over to technicians of the Japanese Onoda Cement Co. for operation. Our Filipino employes were at first reluctant to cooperate with the enemy in operating the plant, but when our chief chemist and a dozen other employes were brutally murdered by the Japs, the rest of our men, who were virtually prisoners, had no alternative but to work. The author was in Manila at the outbreak of the war and was able to get away to the provinces of Batangas and Laguna to join the underground movement. Our dark days lasted until the early part of 1945 when our long-awaited American liberators finally came. We were not too sure, however, of still finding the plant at Cebu, because we feared that the Japs would probably have blown it up during their retreat.

However, strangely enough the plant was not destroyed, and a thorough inspection during the next few days revealed the following:

(a) No serious damage to the plant as a whole, although it had suffered from three years of Japanese operation without any regard for upkeep, maintenance or lubrication.

(b) In an attempt to prevent us from operating the plant, the Japs had removed and carted away the governors of all the three turbo-generators in the power house (these turbines are one Allis-Chalmers 1250 kw., one Swedish Stal 1500 kw., and one Stal 3000 kw.).

(c) The Japs had likewise removed every single V-belt in the plant. Many of our drives and transmissions were of the multiple V-belt type.

(d) The Japs had consumed all the 1942 stock of coal amounting to about 20,000 tons and valued at about

$150,000. There was no gypsum left, no paper bags, no supplies or parts of any kind.

(e) All of the files, papers, and records were gone, although some were found scattered throughout the yards of the plant.

We then learned of the execution of our chief chemist, chief electrician, chief storekeeper and others of our men. Gradually the rest of our workers came in from the hills. All had harrowing tales of hardships, dangers and brutalities during the three years under the Japs.

Army Supervision

The United States Army decided to take over and operate the plant at its expense and under its control. World War II had not yet ended in Europe or in the Pacific. V-E and V-J days were still months ahead. The writer was engaged to take charge of operations of the cement plant under Army supervision.

A portable electric generator was flown in from Manila by the Army to provide lighting at night. V-belts were flown from the United States. We salvaged a discarded governor for our 3000 kw. turbine from the junk yard, reconditioned it in our shop, and began to produce our own power. A shipload of coal was brought in by the Army. We began opening up the abandoned tunnels of our company-owned coal mines in Cebu. Several hundred tons of powdered plaster of paris in bags came in from the Army in response to a request for gypsum. Lubricants, pipe, wiring, paper bags, trucks, gasoline, and hundreds of other items and supplies came in. In a few months we were producing cement, all for the Armed Forces, and some of our APO cement was even sent by plane to battle areas in the Pacific.

Controls Ended

On November 1, 1945, the U. S. Army decided to relinquish control of our cement plant and negotiations were started to return the property to its owner, the Philippine Government. The writer, representing the owners, made a deal with the Army authorities whereby we took over all Army equipment, supplies and inventories to offset whatever rental or lease money was due to the owners for the period of Army use of the plant. We were back in business.

Plant administration offices

Coal washing plant

Manila has been considered as the most badly destroyed city in the world due to the war. The city of Cebu and many other parts of the Philippines also suffered indescribable damage and destruction. The need and demand for cement to repair and rebuild houses, blown-up bridges, piers and port works, and all other damaged structures was far beyond the capacity of our plant. The owners of the only other cement plant in the country, a small 1000 bbl-per-day plant on the island of Luzon, were not in a position to start operations. The government authorities, therefore, decided upon an immediate expansion of the Cebu Portland Cement Co. to double its capacity from 2800 bbl. to 5600 bbl. per day. An appropriation of $300,000 was authorized. The writer made a quick trip to the United States to line up the necessary machinery which in 1946 was difficult to obtain, some of the leading manufacturers requiring as much as two years for shipment.

New Equipment

The following were the principal items that were finally selected and which at this writing are all in operation:

1—Osgood diesel shovel with Caterpillar D-17000, 210-hp. diesel engine, 2½-cu. yd. dipper (we now have four power shovels of various makes in operation in the quarry).

1—Kennedy crusher, 36- x 48-in. heavy duty single roll, driven by a 150-hp. motor.

1—Kennedy roll hammer crusher with a 75-hp. motor.

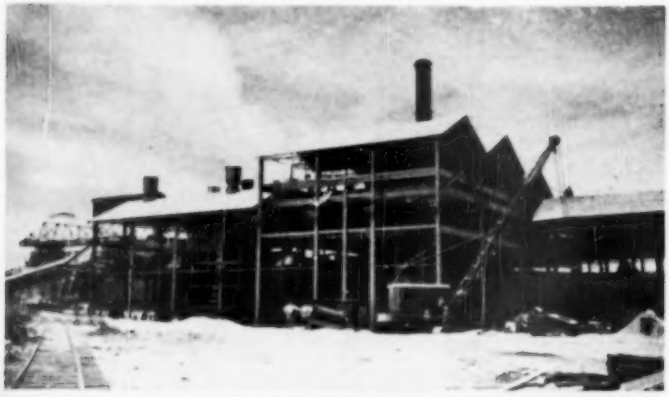
1—Nordberg raw grinding ball mill, 8 ft. 6 in. x 36 ft., two-compartment, driven by a 1000-hp. Worthington synchronous electric motor through a Cutler-Hammer magnetic clutch.

2—Nordberg rotary kilns, 11 ft. x 10 ft. x 175 ft., two support, driven by 100-hp. motors through Falk speed reducers.

2—Oliver American continuous vacuum disc filter units.

2—Vanderwerp recuperators.

One of many employe cottages



Top: Partial view of cement plant showing kilns. Center: Power plant of cement firm. Bottom: Plant during construction

2—Raymond bowl mills, 150-hp. motor drive.

1—Nordberg cement grinding mill, 8 ft. 6 in. x 36 ft., 2 compartment, driven by a 1000-hp. Worthington synchronous motor through a Cutler-Hammer magnetic clutch.

1—Raymond 16-ft. mechanical air separator.

1—5000 kw., 6250 kva., Worthington-Moore turbo-generator unit complete with condensing equipment.

1—Water evaporator plant, Griscom-Russell.

2—Babcock & Wilcox waste heat boilers, 860 hp. each.

In addition, switchboards, Fuller-Kinyon cement pumps, Wilfley slurry pumps, compressors, vacuum pumps, Minogue slurry agitators, conveyors, fans, machine tools for the shop, two Plymouth diesel locomotives, quarry cars, and the usual array of accessory equipment and supplies were obtained.

Plant Extension

Ground was broken for the plant extension in April, 1947, and foundation work started. The entire new plant was in operation in April, 1949. The major portion of the interval was consumed in waiting for the machinery to arrive from the United States. Considering, however, the post-war backlogs and full production schedules that confronted machinery manufacturers in the United States, we received quite rapid delivery.

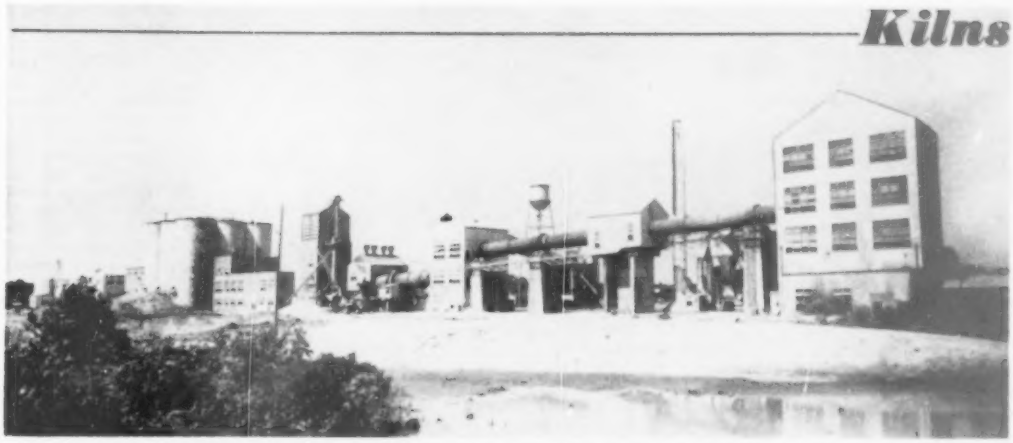
Shortly afterwards, we purchased and installed a coal washing plant in order to improve the quality of low grade Philippine coal. The plant, which is capable of crushing, washing and drying 500 tons of coal in 24 hr., is built around a McNally-Pittsburg coal washer.

The cement plant is now running full-blast and has been producing a little more than 500,000 bags of cement per month. Steps are being taken to increase this production in order to enable the company to cope with the very large demand for cement in the Philippines.

The two coal mines that are owned and operated by the company, and which are located in the same province of Cebu, have also been fully rehabilitated and are now producing about 300 tons of coal daily. The balance of the daily fuel requirements are purchased from other private coal mines.

Employe Housing

The plant has numerous attractive concrete cottages for its workers and maintains a well-equipped hospital as well as playgrounds and recreation facilities. The main office of the company is located in the city of Manila and sales offices are strategically located in various parts of the Philippines.



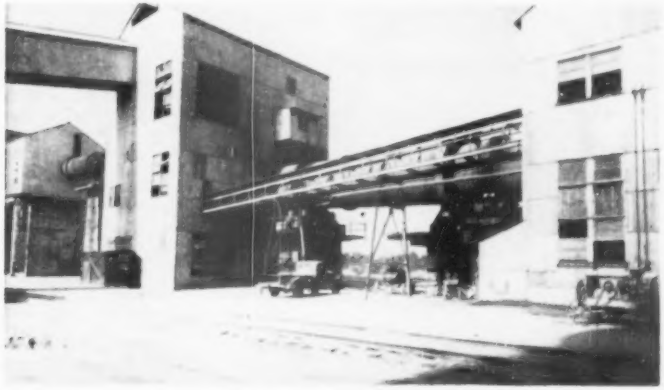
General view of plant. From left are cement silos, clinker grinding department, clinker storage (tall building), kiln, and, on right, raw mill. Note two levels of kiln

WORLD'S MOST UNIQUE ROTARY KILN INSTALLATION

By BROR NORDBERG

Carolina Giant Cement Co., Harleyville, S. C., operates two independent kilns to accomplish results of single, long wet-process kiln, in converting alumina extraction plant to cement manufacture

ONE OF THE MOST UNIQUE portland cement plants in the United States is being operated by Carolina Giant Cement Co. at a location two miles north of Harleyville, S. C., which is some 50 miles northwest of Charleston. The mill has been adapted from an alumina processing plant which was purchased intact and converted into a wet process cement plant. With the exception principally of a new finish grinding department, packhouse and silos, a plant not constructed for cement manufacture is producing cement with machinery and equipment still on their original foundations.

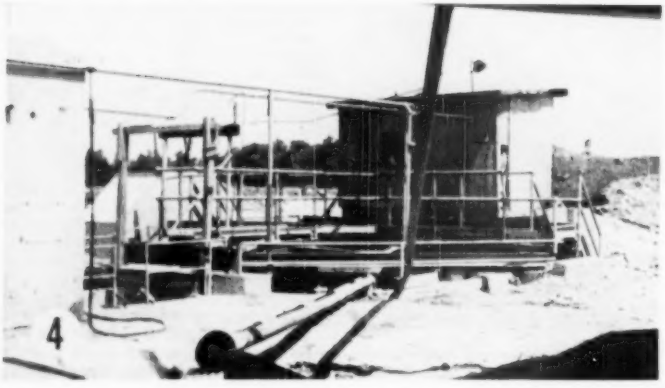


View of two-level kiln. One on left is fired inside kiln building, center; one on right is fired in the building on right

Most unusual feature of the plant is the burning of clinker through two consecutive rotary kilns, each fired independently of the other, but otherwise operated as a single kiln with a transfer between. Also out of the ordinary is the hydraulic separation of excess silica from clay, which is blended and interground with calcareous material for kiln feed, in order to take advantage of locally available material. The plant is straight-line flow, with raw materials entering at one end and being processed right on through to the cement silos and packhouse at the opposite end.

Plant Capacity

Capacity of the plant is relatively modest, rated at about 800,000 bbl. annually. It represents the first production of portland cement in the Carolinas. Heavy deposits of suitable liming materials are scarce in both states and the location of the mill is adjacent to one of very few available sources of required grade and extent. The location is strategic with respect to available markets, there being no other



mill within two hundred miles, and is on the Southern and Atlantic Coast Line Railroads.

Carolina Giant Cement Co. purchased the property late in 1947 and began the manufacture of portland cement in November, 1948. Shipments were started in March, 1949, and since then, emphasis has been on the perfection of plant operation and improvement of production efficiency. There have been difficult problems to solve with the unorthodox kiln arrangement and the need for clay beneficiation and also because existing buildings were converted, where possible, into cement mill departments, but the plant is now functioning smoothly. Clinker production rate compares favorably with that from single kilns of comparable size to the two units operated "separately" as one. Thus far production is of types I, IA and II A.S.T.M. cements, and it is planned later to add the production of high early strength portland cement.

War-time Plant Use

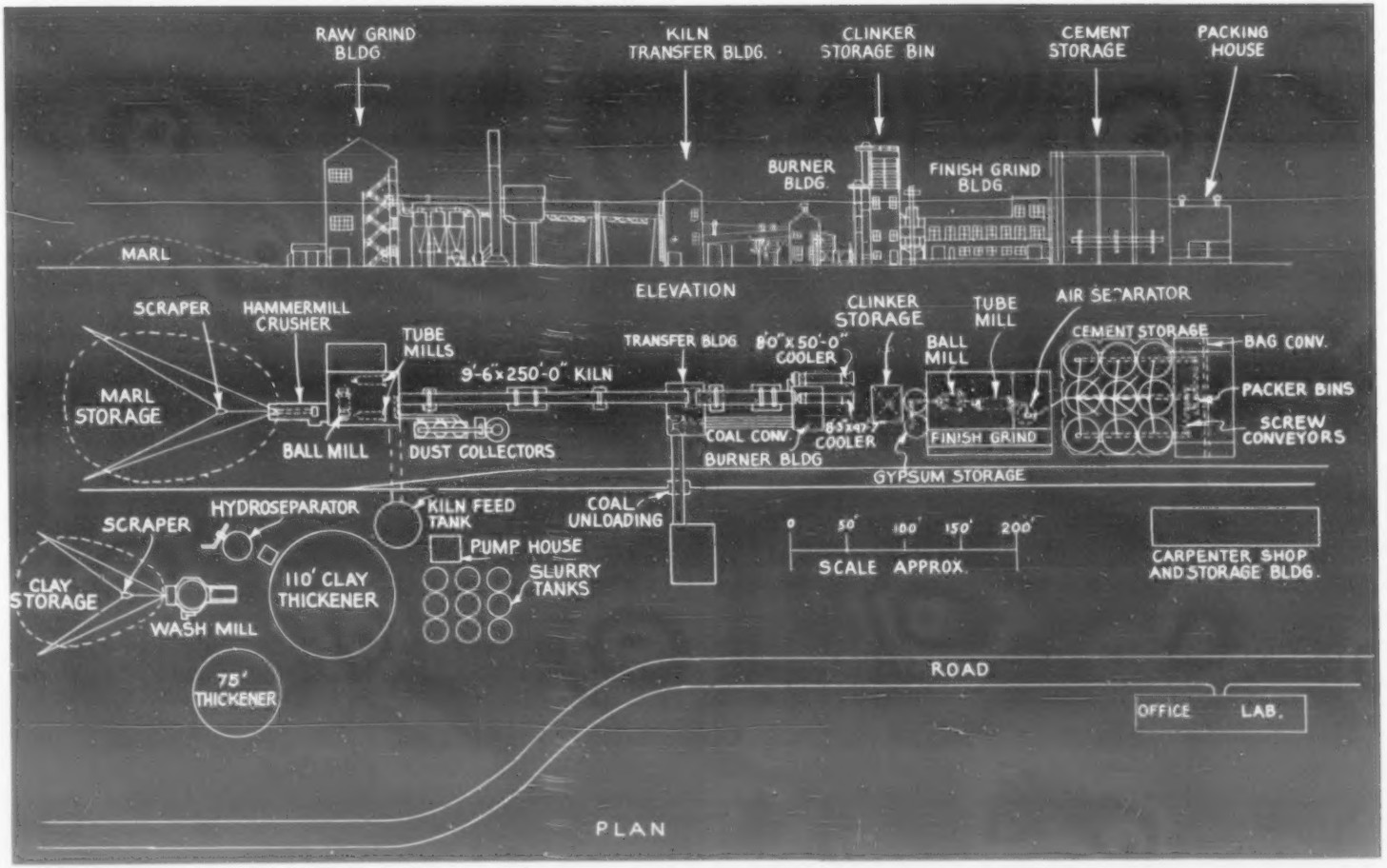
The original plant was one of four semi-commercial experimental pilot plants sponsored by WPB during the war and financed by Defense Plants Corp. to determine the feasibility of extracting alumina from alumina clays by the lime-sinter process. An increase of raw material supply for the aluminum industry, to be used in production of the metal for war use, was the goal. Ancor Corp. was operator of the plant.

Briefly, the alumina extraction process involved the fixation of silica in clay with lime, so that the silica could be removed. The conversion of SiO_2 to dicalcium silicate was accomplished along with the conversion of Al_2O_3 to calcium aluminates, and minor constituents to ferrites, etc. Processes comprised the mining of clay and limestone, clay treatment, milling, sintering and the grinding of sinter, leaching, de-silication, hydrate precipitation and alumina calcining. A calcining kiln and a reaction kiln were key units in the process, and it is these two kilns which are operated together in the manufacture of cement.

Location of the plant was established by the availability of high lime materials, this material being the greatest tonnage involved in the process; the source of kaolin clay was at Aiken in western South Carolina.

All the buildings, most of which are now in use, are of either concrete, or steel and asbestos cement siding, construction. The original raw mill building, a 45- x 65-ft. 4-story structure, is

LEFT —
(1) Marl is excavated with the aid of a small amount of blasting for haulage in 10-ton trucks to plant. (2) Stripping of clay overburden by dragline. (3) Earth mover transporting clay to wash mill. (4) Wash mill where clay lumps are broken and water added to effect separation of silica from clay in hydroseparator



Plan and elevation of converted alumina extraction plant used by Carolina Giant Cement Co. for cement production

Clinker is elevated direct from coolers into overhead 5000-bbl. bin. In background are finish mill building and silos

in use, as are the 27- x 42-ft. sinter building and the machine shop, pumphouse, a concrete masonry office and laboratory, warehouse, first aid building and other structures. The de-silication tower, a six-story building, is used for clinker storage, and finish grinding is done in what was the leaching building.

In the purchase of an entire plant like this, certain facilities were, of course, unadaptable to cement manufacture, including a steam power plant, a thickener and lesser equipment. Additions required were storage and packing facilities for cement, clinker grinding equipment and additional slurry storage tanks.

Raw Materials

Source of limestone is a deposit of shell origin, probably clam shells in part, which is classified locally as a marl. Actually the material has the appearance of a soft decomposed limestone, which requires very little blasting. It is a high calcium material, running better than 95 percent $CaCO_3$, with from one to two percent SiO_2 and with less than one percent each of Al_2O_3, Fe_2O_3 and MgO. Overburden consists of a sandy clay, which is selectively excavated for delivery to the plant. When operations have become stabilized, overburden will average 15 ft. and a 60-70 ft. face of stone will be worked likely on two or more benches. The property purchased with the plant has 200 acres of land with an excess of 15,000,000 tons of available marl.

At present, the marl is excavated by power shovel into trucks, the benching method being preferred because of a water condition. Being in low, swampy country, there is a continuous flow of water from the face which must be diverted from the marl being loaded through diking. Otherwise the stone, which is spongy, will take up as much as 25-30 percent water, which will result in too high moisture for kiln feed after blending with clay slurry. Average moisture content of the stone as delivered to the plant is 15 percent.

A 1¼-cu. yd. shovel now in service soon will be replaced by a 2½-cu. yd. Northwest diesel shovel which, it is believed, will permit excavation without any blasting. Haul to the plant is a distance of one-quarter mile in two Euclid diesel-powered end-dump trucks carrying 10 cu. yd. to the load. The trucks dump to a stockpile at the plant and the marl is reclaimed for processing by a Sullivan 3-drum, hoist-operated scraper.

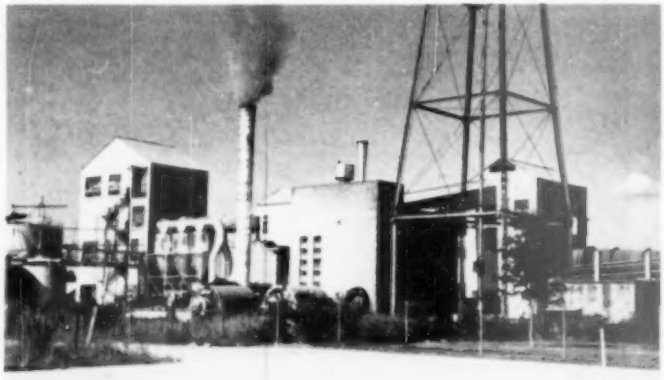
Due to the high calcium carbonate of the marl, approximately 20 percent of the raw material fed the kiln is clay which is excavated in stripping. A problem encountered was the high silica content of the clay and lack of uniformity which is characteristic of coastal plains deposits. Selective digging is required and certain sections of the clay are discarded as unsuitable. Excavation is by 6-cu. yd. diesel-powered Tournapull which delivers the clay to the plant.

Silica ratios as high as 3½ and, on occasion, 5 and 6 are being processed at the plant to yield a product of 2.4-2.5 silica ratio. Actually, three distinct grades of clay are being excavated in approximately desired proportions for plant delivery, where they are intermixed and processed for silica removal. These grades run from siliceous clays to almost pure kaolin, some of the clay containing as much as 35 percent alumina. One grade is a heavy, blue clay containing coarse-grained silica, the second is higher in silica, which occurs as fine sandy grains, and the third is kaolin-bearing material which is low in silica and high in alumina.

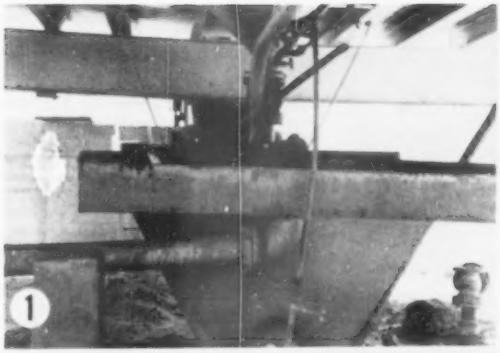
Wash Mill

The best combination is delivered into a stockpile at the wash mill, where it is reclaimed into the mill by a Sullivan 12-cu. ft. drag scraper. The wash mill is a Smidth 26-ft. diameter unit, in which the clay is broken up and water added to 80 percent of the total for most effective separation of the sand grains by a hydroseparator. Product of the wash mill is pumped into a 25-ft. (5 ft. deep) Hardinge hydroseparator which makes the separation of the granular silica particles from the clay, the water addition and amount of feed controlling the separation. The silica underflow is discharged into a stockpile by a Hardinge 18-in. spiral re-

RIGHT —
(1) Reclassifier in conjunction with hydroseparator for silica removal from clay. (2) View of hydroseparator which discharges underflow of silica to reclassifier. Note earth mover delivering clay to wash mill in back of it. Thickener is on left. (3) Partial view of slurry tanks with kiln feed on right. (4) The 110-ft. clay thickener. One in back is not used. (5) Raw tube mills (two) discharge slurry for pumping into tanks. (6) Ferris wheel feeder for slurry feed is synchronized with kiln speed. (7) Firing hood on lower kiln—oil-fired. (8) Hood on upper kiln, which is also fired with oil. Optical pyrometer measures heat on transfer wall

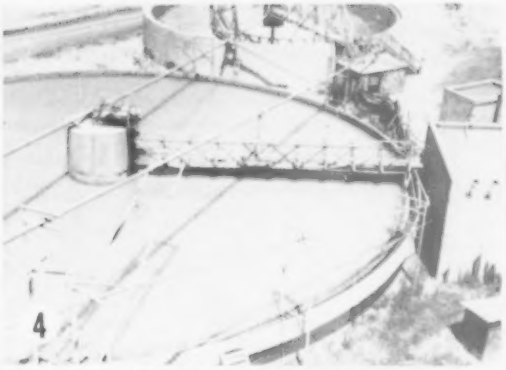


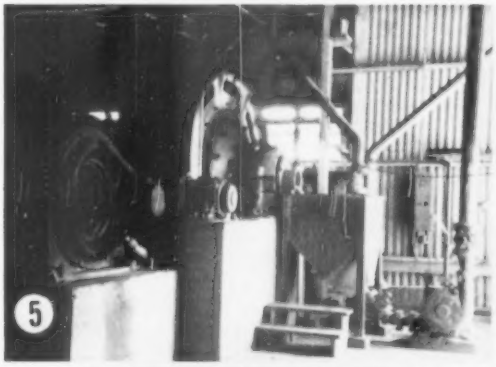
Another view of plant. Slurry silos are on left; raw mill and stack collectors are in back, to left of stack. Building to left of tower in foreground is power house, not in use at the present time

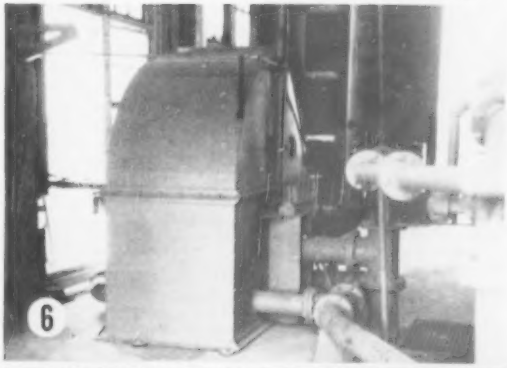

1

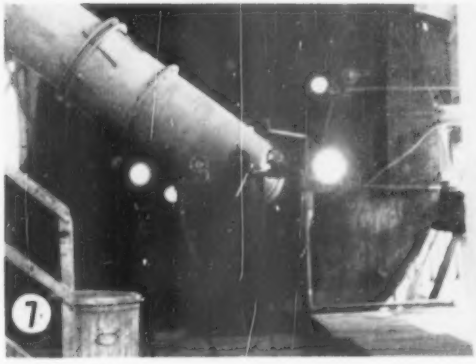

2

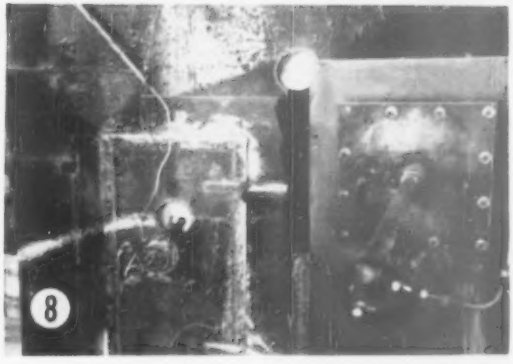

3

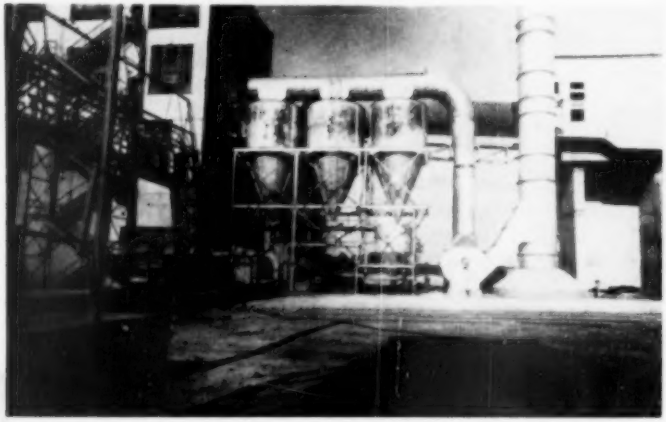

4


5


6


7


8



Stack dust is settled in three cyclone dust collectors and pumped by cement pump to disposal

classifier and the overflow, with 86 percent H_2O, and a fineness of 70-80 percent minus 325-mesh, is to a 110-ft. Hardinge thickener which is center-pier supported and of the center-drive type. Sand removed by this process is of a grade that might be suitable for masons sand.

Underflow from the thickener contains 70 percent moisture and is pumped by Wilfley slurry pump into two holding tanks.

Marl Handling

Marl is handled in storage by scraper and reclaimed into a hopper from which a 36-in. Link-Belt inclined apron feeder regulates the flow into a No. 40 Williams slugger-type hammermill driven by a 100-hp. motor. This phase of the operation is of interest because the clay slip is introduced from the holding tanks into this mill in the proportion desired. Thus, the hammermill is operated wet, with a feed sufficiently high in water to prevent plugging. Output of the mill, which is elevated for grinding mill feed, is 100 percent minus ½-in. and 70-80 percent minus 20-mesh, with approximately 35-40 percent contained water. Additional water is added in the grinding operation.

Slurry storage capacity consists of nine 20-ft. dia. by 20-ft. tanks of 400-bbl. (clinker) capacity each. They have mechanical and pneumatic agitation and are of both Smidth and Dorr manufacture. Five of the tanks are new. Two are set aside for storage of clay slip as delivered from the thickener and from which the clay is continuously drawn, and the others are utilized for slurry storage, correction and blending. In addition there is a steel kiln feed tank of 1600-bbl. (clinker) capacity.

Slurry Grinding

Raw grinding is done in two stages, in open circuit, to a kiln feed fineness of 90 percent minus 200-mesh. Preliminary grinding is through a 9½- x 11-ft. Nordberg mill driven by a 450-hp. motor at 19 r.p.m. Ball loading is 40 percent of 80,000 lb. of forged steel grinding balls. The replacement size is 1½ in.

Discharge from the preliminary mill is gravity-fed in a divided stream to two 5- x 22-ft. Hardinge tube mills driven from 200-hp. motors at 27 r.p.m. The ball charge in each is 40,000 lb. (1-in. replacement size) of forged steel balls. Wilfley pumps transport the mill output into slurry tanks. Slurry is ground with a slightly lower moisture content than the holding point for kiln feed and a small fraction of water is added to the blending tanks for correction to bring the moisture content to a constant 43 percent. Raw grinding is a 24-hr. operation.

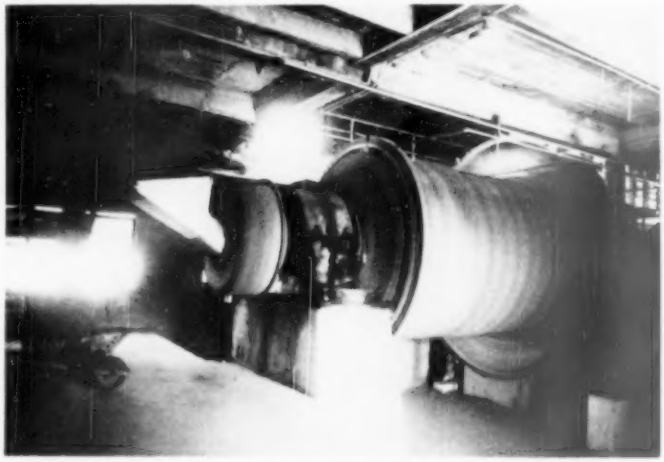
Kiln Operation

Operation of the two kilns is extremely interesting because they are operated as one kiln, yet both are fired separately to attain the temperature gradient that would hold throughout a single rotary kiln equivalent in length to the combined kilns.

As stated earlier, the previous operators of the plant required two separate kilns in the alumina-extraction process for which the plant was built. These were a calcining kiln and a reaction kiln. One is 9 ft. 6 in. x 250 ft., of Traylor manufacture, and the other is 11 ft. 6 in. x 85 ft., manufactured by Allis-Chalmers. The longer kiln has is center line 16 ft. above the short kiln. Both slope in the same direction at ½ in. to the foot and, as shown in the accompanying elevation drawing and photographs, terminate at the common kiln building between. In the alumina operation both were fired from within this kiln building, the lower kiln being fired downhill in the direction of travel of the material flow.

In adapting this arrangement of two kilns to the manufacture of portland cement, it was decided to join the two kilns and operate the two together as a single long wet-process kiln in order to achieve the fuel economy inherent to long kilns. This was done by building a transfer housing and lining it with refractory brick. Thus, the material in the kiln has a drop of approximately 16 ft. to enter over a 9 in. back dam installed in the second kiln.

At first, this kiln arrangement was fired by oil only from the discharge end of the lower kiln, with the gases traveling up through the transfer housing to the back end of the upper kiln to exhaust through the stack. After much experimenting in actual



Preliminary ball mill on finish end is for open circuit grinding followed by tube mill in circuit with air separator

production, it was decided to fire both kilns simultaneously. Therefore, a second oil-firing tip was installed at the transfer section with the flame directed into the discharge end of the 9-ft. 6-in. x 250-ft. kiln. The results have been quite favorable.

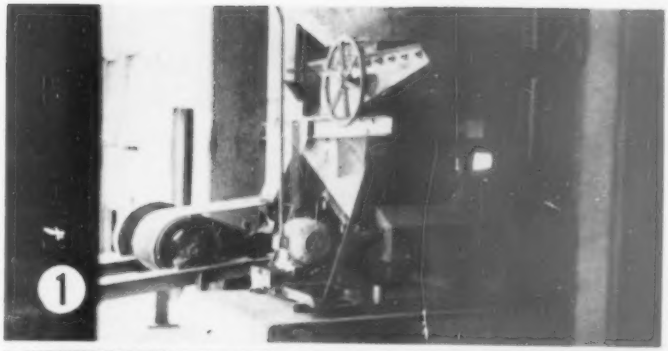
Each kiln is driven independently of the other by a 75-hp., 440-volt variable speed motor. The lower one is turned clockwise when viewed from the firing hood, and the upper kiln revolves counter-clockwise, which just happened to be the way the drives were arranged and has no bearing on the burning of clinker. Turning speed of each kiln is held at 60 seconds per revolution under normal conditions.

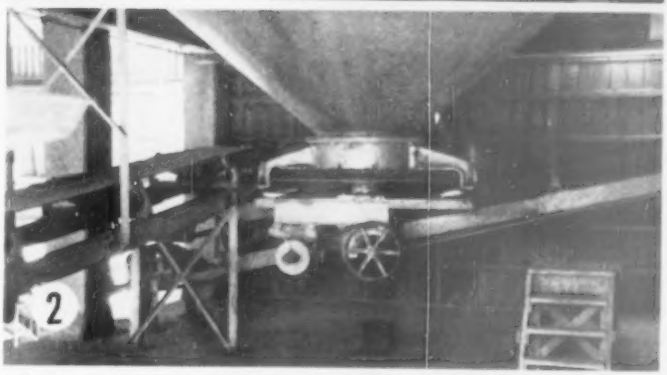
Both kilns are lined with 6-in. refractory brick throughout, with 70 and then 60 percent alumina brick in the lower kiln and standard cold zone brick in the upper kiln. Starting from 10 ft. in front of the cold end of the upper kiln, ⅝-in. heat exchanger chains are hung for a distance of 65 ft. The transfer housing is lined with 60 percent alumina brick and the slope over which the material flows has high silica brick.

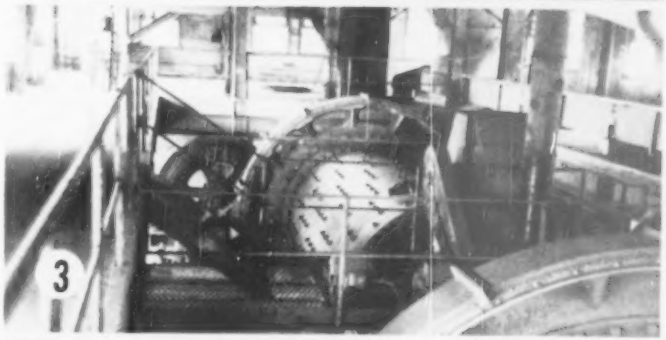
Both kilns are fired with No. 6 bunker C fuel oil with a heat rating of 150,000 B.t.u. per gal., and primary air for combustion is introduced at atmospheric temperature supplied at each firing hood by blower fans. Secondary air in the lower kiln is preheated through the induced draft fan drawing cooling air through rotary clinker coolers. For emergency, a Strong-Scott direct-firing coal mill is available. The junction between kilns is in the calcining section. No clinkering takes place until the material enters the lower kiln. Firing of the upper kiln is adjusted to maintain a temperature of approximately 2000 deg. F. at the transfer in order to maintain the temperature increase in a straightline throughout, the temperature of the gases coming out of the lower kiln being at approximately that temperature.

Firing of the lower kiln is regulated so that the oxygen for combustion is consumed before the gases reach the transfer. The oxygen required for the upper kiln firing therefore must be supplied independently by fan to burn the oil fired at the upper hood. Exit gas temperature is approximately 525 deg. F. As a rule, the speed of the long kiln is held constant

(Continued on page 316)

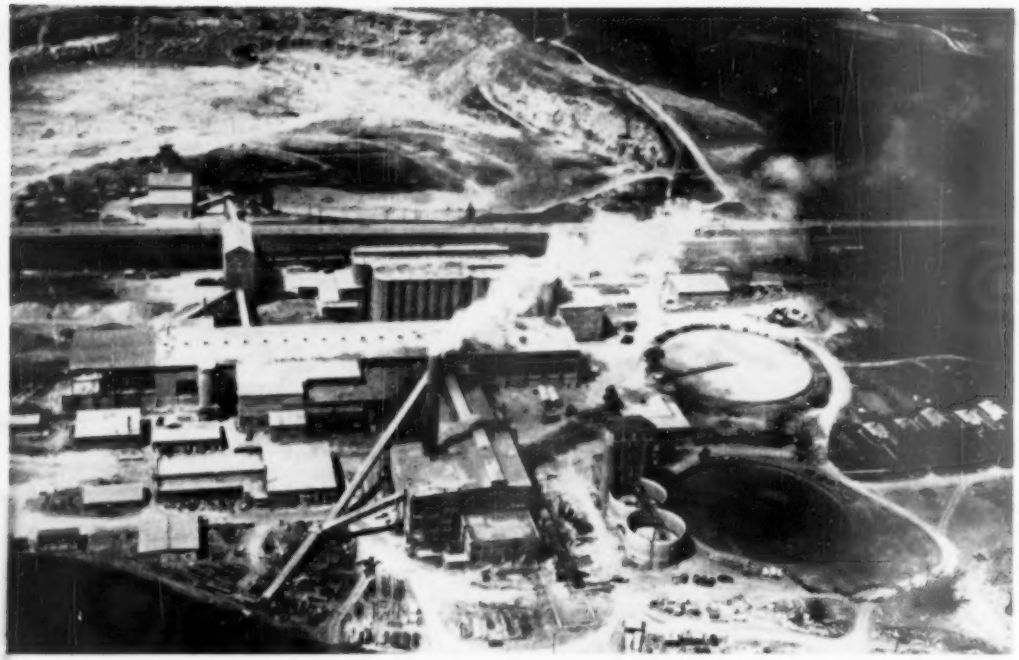






RIGHT —

(1) Gypsum feeder, interlocked with clinker feeder for grinding mill feed. (2) Feeder for clinker. Conveyor on left handles gypsum; on right, belt feeds clinker and gypsum into grinding mill. (3) Two-stage grinding equipment on clinker. Finish mill in back is operated in circuit with air separator. Preliminary mill in front is operated in open circuit. (4) View of packing equipment. Reversible wire mesh conveyor enables loading to cars on both sides of packhouse



Overall view of plant showing quarry in background, thickeners on right with new slurry tanks alongside, kiln building in foreground, and crushing plant at left background with conveyor spanning highway

Dewey's Expansion Program Completed at Davenport

Capacity increased 40 percent with 11- x 375-ft. kiln. Burners trained to rely on instruments in firing. Program also includes added finish grinding capacity, cement storage and packing, and increased slurry facilities

By BROR NORDBERG

PRODUCTION OF CLINKER and portland cement have been increased by 40 percent, and the plant generally modernized, with completion of a two-year program involving expenditure of $2,000,000 at the Davenport (Linwood), Iowa, plant of Dewey Portland Cement Co.

This mill, prior to enlargement and renovation, was rated at 4500 bbl. of clinker per day. It is a wet process plant and is one of relatively few in the industry that has operated short kilns and which are fed filter cake, in connection with waste heat boilers. There are three 11- x 175-ft. kilns so operated. Each is fired by a B & W direct-firing unit coal mill and is equipped with an air-quenching clinker cooler. That part of the operation and the raw mill have undergone no change in the recently completed program.

Production of clinker has been stepped up by 2400 bbl. per day with installation of an 11- x 375-ft. rotary kiln, which represents the largest single investment. Finish mill capacity was increased proportionately with the addition of two new grinding mills and is now capable of grinding 9000 bbl. of cement per day.

Raw mill grinding capacity was sufficient equipment-wise and the only change made necessary to fill the increased demand is a greater number of operating hours for the raw mill. However, other changes were necessitated in the raw end in connection with the slurry handling, storage and blending, in order to secure better control of slurry composition and to provide greater capacity for flexibility in blending and control in handling a greater quantity of slurry per day. New blending tanks and proportioning tanks were built and thickener capacity was doubled, with the result that the slurry for any day's operation of the kilns can now be made up and corrected the day before.

In addition to the foregoing, necessary installations for purchased power had to be made since the long kiln does not contribute to the generation of power from waste heat but increases the plant load. Storage capacity for cement was enlarged with the building of new silos, and a new packhouse

and bulk-loading facilities were built. The plant is located on the Mississippi river and receives its coal supply in barges at a recently completed 500-ft. concrete dock. There have been occasions, in serving large projects, when shipments of cement and crushed stone have been made by water. The plant is a substantial producer of crushed stone and agricultural limestone.

A 4-cu. yd. shovel casts over stone from top bench to quarry floor for rehandling

New Kiln

To accommodate the large kiln, a new building was erected adjacent to the main kiln building and the installation was made so that all four kiln hoods are in line. The new kiln installation basically consists of the 11- x 375-ft. rotary kiln, direct-firing unit coal pulverizer, ferris wheel slurry feeder, air-quenching clinker cooler, synchronous tie between the rate of feed and kiln speed, and induced draft fan with exhaust through a 40-ft. high insulated steel stack.

Firing is done with preheated primary and secondary air and the entire operation is highly instrumentalized with many automatic features for the control of firing variables centralized at a master instrument board. The kiln, clinker cooler, ferris wheel feeder, synchronous tie between rate of feed and speed of kiln, ferris wheel feeder, master kiln control cubicle, and the related drives and electric motors are of Allis-Chalmers manufacture.

Length of kiln was selected on the basis of experiences as observed throughout the cement industry, and a diameter of 11 ft. was specified partly in the interests of standardization of refractory brick sizes and shapes as used in the older kilns. It is an all-welded unit with ¾-in. shell, carries a ½-in. slope and rides on six sets of water-cooled 48- x 24-in. forged steel rollers which have water-cooled bearings. The kiln has a tight-fitting hood to eliminate air leakage and an air-cooled discharge end of segmented alloy steel. At the feed end, the kiln projects into an insulated dust chamber, with floating type of air seal connection. The dust chamber has dimensions that provide for possible future installation of a dust collector on the suction side of the induced draft fan. The stack is insulated to prevent condensation.

Draft is supplied by a size 8 Sturtevant double-inlet, induced draft fan designed to handle 110,000 c.f.m. of gases at 4-in. w.g. resistance pressure when driven at 438 r.p.m. It has water-cooled bearings, outlet type of louvre damper and is driven through Texrope from a 125-hp., 900 r.p.m. high torque motor. Slurry is fed into the kiln by a 13-in. ferris wheel, which has a calibrated slurry measuring tank and Texrope-driven speed changer.

Refractories

Lining of the kiln consists of 6-in., 70 percent alumina brick for the front 5 ft., followed by 79 ft. of 6-in. basic brick through the burning zone, 40 ft. of 70 percent alumina brick in the calcining zone, and the balance to the chain section is 40 percent alumina brick. The chain section is lined with 7½-in. castable refractory for 55 ft. of its length and then with 4-in. castable to the back end of the kiln.

The chain section comprises 54,000 lb. of ⅝-in. oblong link chain hung on planes from spiral lifters. It starts 5 ft. from the feed end of the kiln and consists of a dense pattern throughout. Slurry is fed into the kiln at 35 percent H_2O.

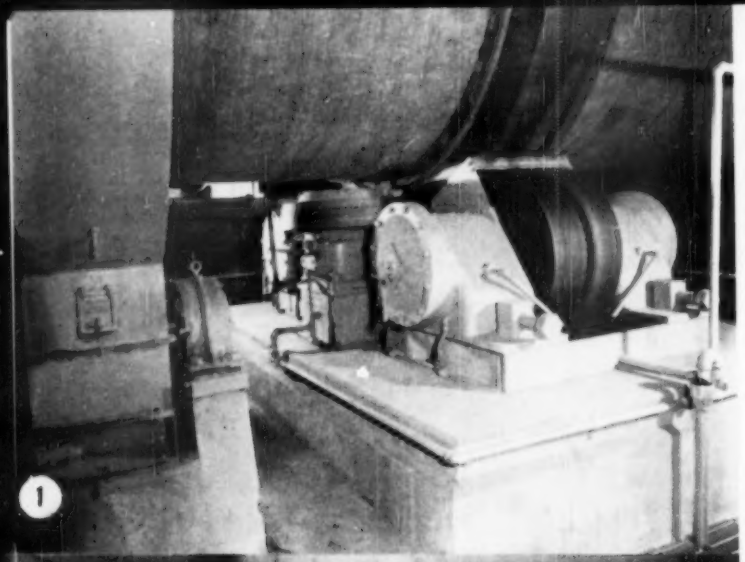
This plant is one of the first in the cement industry to use castable refractories and, as a result of continuous successful use of various castables in cement plant installations for the past ten years, has lined the chain section of the new kiln with abrasion-resisting castable refractory.

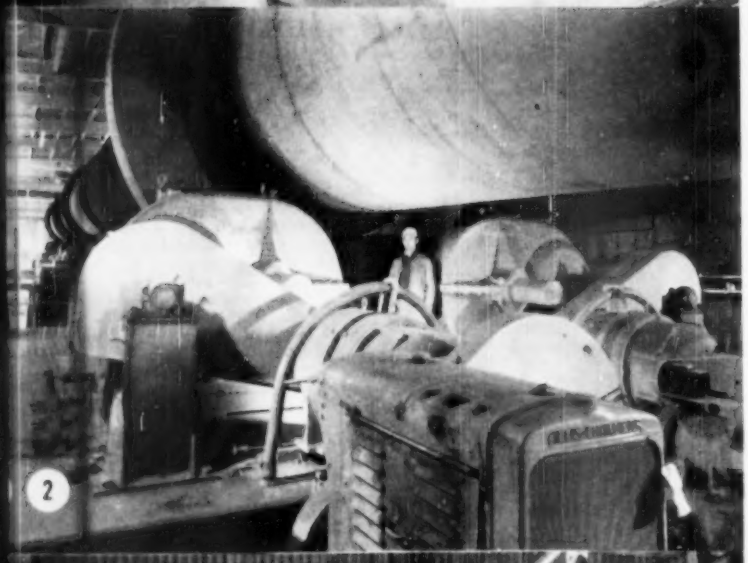
Castable refractories are dry materials available in bags which are mixed with water into a refractory concrete and placed much like ordinary concrete. The material has hydraulic setting properties and requires less water than ordinary concrete. Setting time is about 5 hr. for the type castable used for kiln lining. The type used for a distance of 80 ft. in the chain section of the Dewey kiln is an abrasion-resisting castable which is cast in four quadrants (one a day). This is the first use of commercial abrasion-resisting castable refractory in the industry. Among the advantages experienced are that these linings are quickly and easily applied. They eliminate cutting of brick and simplify the fitting of chains in the chain section. There are no joints for dust to enter.

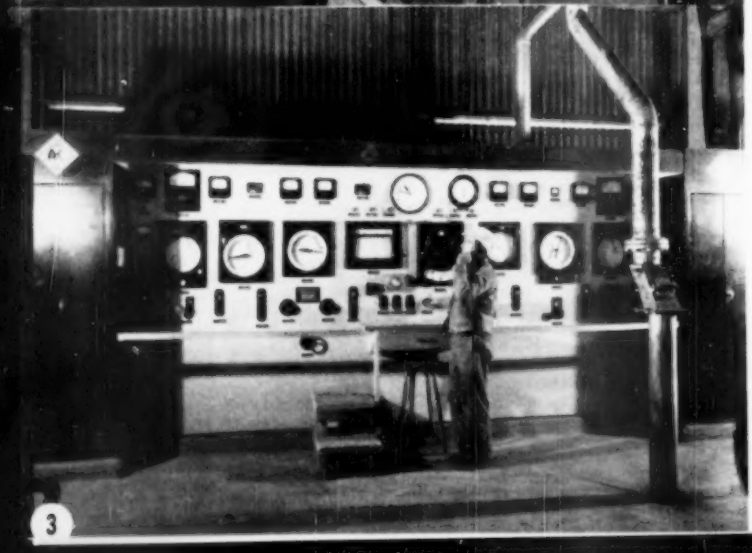
Castable refractories are in service in three clinker coolers, all four kiln hoods and the back end housings of one of the kilns. The type used in these locations takes its initial set in approximately 20 min. In the kiln housings a 9-in. castable is applied to 4-in. Green block insulation, and an 8-in. lining was placed over 2-in. insulation inside the kiln hoods and in the arches of the clinker coolers. For the hot edge in the kiln hoods "Super Hybond" castable having high resistance to heat has been applied.

The drive is possibly the first adjustable dual-drive helical gear in-

Personnel, left to right, are C. E. Hartwig, combustion engineer; H. L. Egger, plant engineer; G. H. Roop, master mechanic; E. S. Ernst, assistant works manager, and G. R. Cross, general mill foreman. F. B. Hunt, works manager, is seated







stallation in the cement industry and is variable speed with A-C synchro-tie, consisting of a 9.4 kw. Texrope-driven generator to synchronize the slurry feeder speed with the kiln speed. Each of two 60- to 75-hp. d-c (230 volt) motors, with speed range of 300-1200 r.p.m., drives through Texrope a pinion which engages the ring gear. Motors are in balance to drive the ring gear. Two rheostats on the master instrument board are the means of balancing the motors (speeds and loads). Practice in firing the kiln is to set the kiln speed manually by rheostat, then balance the drives, and hold the rest of the firing variables automatically in balance.

With this drive, the kiln revolves smoothly. There is no jerking or tendency to walk, due to the perfect contact that can be maintained between the gear teeth. The base of the pinion gear can be moved for adjusting the clearances between the gear teeth. In emergency, one of the d-c motors can drive the kiln. Normal full loading is 120-125 amps. on each motor and the peak is 168 amps. Direct current is supplied from a 150 kw. d-c motor generator driven by an 1800 r.p.m. induction motor. For standby, in order to turn the kiln in event of power failure, an auxiliary drive has been provided consisting of a W 25 A-C 4-cylinder gasoline engine with a gear reduction unit which is engaged by clutch to the driving gear.

Coal Pulverizer

Coal fired in the kilns is Illinois coal shipped to the plant in barges. It has an average heat value of 11,275 B.t.u. per lb. as received.

From a 90-ton overhead bin, the rate of coal feed to the pulverizer is regulated and recorded by a Richardson coal scale which has a 200-lb. dump hopper. This is an automatic operation by which a counter-balance is the means of release of a 200-lb. batch of coal into the hopper after the previous batch has been drawn down so that the counter-balance can release. Consumption of coal is recorded by a weight totalizer.

Coal is pulverized by a No. 493 Raymond bowl mill with integral roll-type feeder, double-cone classifier, adjustable deflectors for fineness regulation and an integral exhaust fan. The drive is a 150-hp. electric motor. Fineness of grind is 73-75 percent minus 200-mesh.

Primary air is drawn out of the top of the kiln hood through a 7-ft. 6-in. dust trap, according to standard practice, and enters the mill through an insulated pipe. Temperature of the air entering the mill is held at 650-700 deg. F., controllable by damper according to the outlet temperature which, for the coal-air mix, is held

---

LEFT —
(1) Water-cooled carrying mechanism on rotary kiln. (2) Adjustable dual drive with helical gears drives kiln. Note auxiliary gas engine drive. (3) Master kiln control board

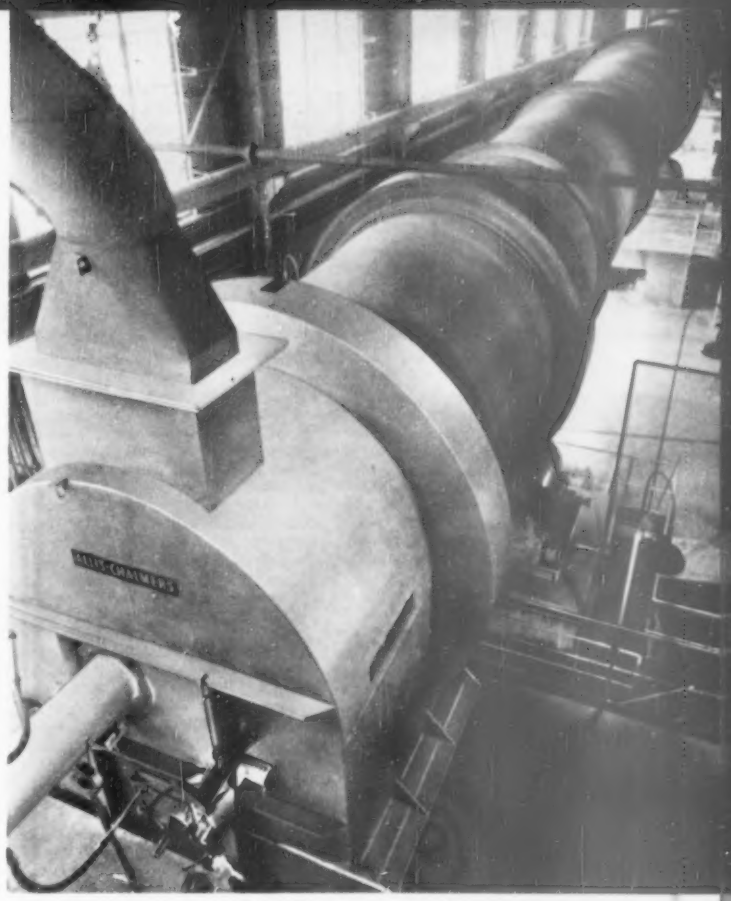
at 195 deg. F. A two-pen thermometer on the control board is the means of automatically tempering the hot air into the mill, through an airmotor which opens and closes the damper. Coal plus primary air is fired into the kiln through a 14-in. water-cooled burner pipe. Primary air is 25-30 percent of total combustion air.

Clinker Cooler

Clinker is burned at 2700 deg. F. and discharges at 1800 deg. F. over a 4-ft. 6-in. x 70-ft. air-quenching clinker cooler. Similar coolers are operated in connection with two of the older kilns, having replaced rotary coolers several years ago. The fourth kiln has a Fuller cooler.

The cooler has a d-c drive for variable speed and has heat resisting cast iron grates for the first 24 ft., with the balance (40 ft.) of cast iron. It is of the reciprocating grate-type in which the clinker is conveyed and agitated in a blast of air, the hottest portion of the air being drawn off through a stationary housing as secondary air for combustion in the kiln. The balance of the air serves to cool the clinker further and exhausts through a stack. Operating speed ranges from 260-340 strokes per minute, and a constant-speed fan of 55,000 c.f.m. capacity with louvre-type outlet damper delivers air through the grate from below at 4-in. w.g. resistance pressure.

Secondary air flow entering the kiln from the clinker cooler, about 22,000 c.f.m., is held constant by automatic regulation of the grate speed through measure of resistance pressure, which is a function of thickness of clinker bed. A constant thickness of bed is maintained by means of a pressure switch controller which operates a pilot motor and changes the cooler grate speed by means of a rheostat in the field circuit of the d-c cooler grate drive. Varying the cooler pressure will reflect in the volume and temperature of preheated air entering the kiln and is a means of changing firing conditions. Clinker discharges at 80-120 deg. F. over a Merrick Weightometer for a record of production and is dumped into a pile in the undercover storage area for rehandling by overhead crane.



Newly installed 11- x 375-ft. wet process rotary kiln, driven by helical gears

Kiln Operation

It was felt, in installing the new kiln, that instruments are the means for maintenance of ideal burning conditions, in order to attain uniformity of product and greatest operating efficiency, so the new kiln has been equipped for as complete operation through instrumentation as practicable. Men who had had no previous experience as kiln operators were trained to be burners so that they would have no prejudices in learning to operate the kiln through use of instruments. The result has proved favorable in comparison with the product from shorter kilns. Free lime is consistently well below 1 percent, and excellent compressive strengths are obtainable from cement ground from clinker out of the long kiln. The clinker is a small, very hard lustrous material.

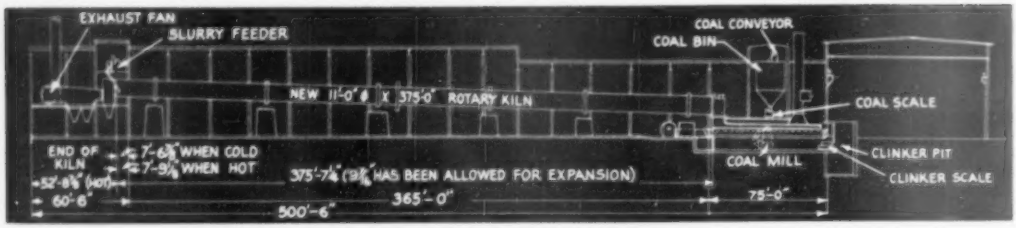
All instrumentation, including the controls for the clinker cooler and the direct-firing coal mill, are centralized on a single master kiln control cubicle.

Among the controls is a kiln draft control system to maintain automatically a constant draft at the firing hood consisting of a Brown constant furnace pressure controller and a Brown damper drive unit. The system includes a handwheel for manual operation of the damper, a damper position indicator and signal lights.

Temperature Recording

A Hays instrument indicates the feed-end draft and the hood draft. The louvre damper at the draft fan has alternate drives available—by airmotor and electric motor—and may be

New slurry storage and blending tanks installed to increase capacity



Elevation of new kiln and its accessory equipment

automatically or manually operated. Back-end draft is emphasized since it is more stable, and is carried at about 1 in. w.g. A radiation pyrometer for measuring the burning zone temperature consists of a Brown circular chart, recording temperature as measured by radiamatic pyrometer. This reading is taken at the burner level and on the lining in the hot zone, which is preferred for quicker response with contemplated automatic control of the firing rate. Then the circuit will be hooked to the feeder of the coal mill.

A potentiometer system for recording exit gas temperature includes a Brown Electronik circular chart and thermocouple, and an alarm horn detector to safeguard the induced draft fan against excessive temperature. Exhaust temperature is 450-500 deg. F. as measured in the breeching.

A kiln speed indicating recorder system includes a Brown indicating speed recorder and a tachometer at the kiln drive motor, also the rheostats for balancing the two kiln drive motors. The kiln is being driven at 83 r.p.h., as a maximum, in producing 110 bbl. of clinker per hr., the idea being to have a thinner bed than ordinary in the kiln. Retention time is 4 hr.

Oxygen Analysis

A Hays oxygen analyzer is used as a continuous indicator of burning efficiency and as a guide instrument. The holding point for O_2 is between 1.2 and 2.4 percent. If the figure gets too high, usual practice is to cut the draft, the alternative being to increase coal input. There is a four minute time lag from the analyzer before a reading is indicated on the board. This instrument will quickly indicate a shortage of fuel and is used as a basis for application of the other instruments. The kiln has automatic draft control but it is not hooked to the oxygen analyzer.

Thermocouples

An important control device is the use of thermocouples to maintain consistency of slurry through the chain section. Two thermocouples, 180 deg. apart for an average figure, record on the Brown potentiometer the temperature as measured 2 ft. in front of the chain section of the kiln; there is also another at the kiln housing to record the exit gas temperatures.

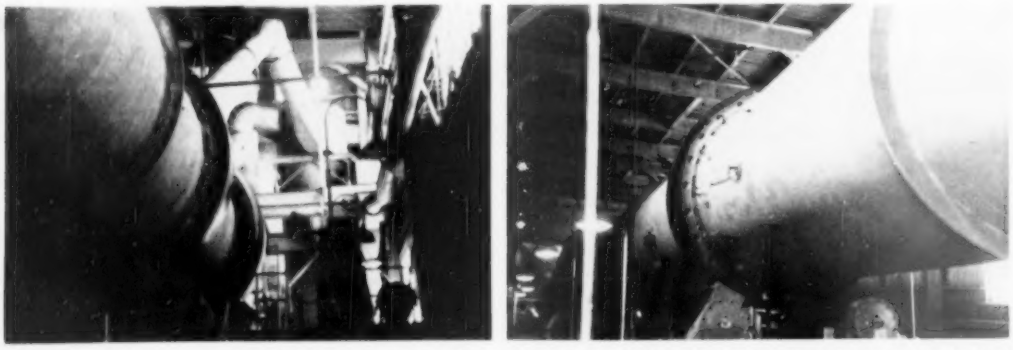
The reading just ahead of the chain section is held at 1150-1200 deg. F., which is a measure of consistency of slurry to be maintained in order to prevent mud ring formation. At this figure, the consistency of the slurry is 0.5 percent moisture which is desired, and which is sufficient to protect the chains from burning out.

If the temperature goes over 1200 deg. F., that is an indication that there is formation of a ring or starvation of feed material for other reasons, and steps can be taken to correct the condition. Should the condition continue, the need for shutdown for ring removal is indicated. Too high a temperature may also indicate that the slurry is too dry and the kiln may then be speeded up to compensate. If the temperature at this point drops below the desired figure, that is an indication of too much moisture in the slurry and necessitates changing the draft or the rate of coal feed. Should a mud ring break, that condition would reflect in a temperature drop as much as 100 deg. F. within a minute. Then the operator can anticipate the condition to be encountered later in the hot zone. This instrument is proving extremely important in the control of uniformity and to prolonging refractory life by maintenance of a consistent depth of material in the kiln.

Clinker Cooler Instruments

Among instruments in connection with the clinker cooler is an automatic Shallcross cooler speed controller. The cooler speed is controlled by increase or decrease in pressure under the grate of the cooler. If the pressure increases over a set figure of 2-in. w.g., the cooler speeds up to thin the bed. The device is really a flowmeter at the cooler which is connected to the instrument board where it is measured as pressure. This instrument is of importance because variations in the cooler pressure would prevent holding the flame in the kiln. It is also essential to efficient coal mill operation and will affect other instrument readings including that of the oxygen analyzer.

The principal instruments for coal



Left: Firing end of new wet process kiln. Note trap to settle clinker dust from hot air duct to coal mill. Right: View of new kiln from feed end showing locations of thermocouples to measure temperature as a control of slurry consistency coming out of chain section

mill operation are a 2-pen recording thermometer, primary air and feed regulator and a draft gauge. Temperature of the coal-air stream coming out of the mill automatically activates an air motor on the bleed damper for incoming air.

Other instruments include a cooler grate speed indicator, overtravel light and ammeter for the grate motor drive; air flow meter into the cooler fan; damper control for the cooler fan; ammeters for the coal mill, cooler fan, kiln drives and induced draft fan motors; kiln revolution counter; slurry feeder revolution counter, voltmeters for a-c and d-c line voltages, totalizer for kiln revolutions and for the ferris wheel feeder; a clock; and warning lights to indicate that the slurry feeder is operating and overflowing and to indicate excessively high exit gas temperatures. There are telephones at the control board and at the feed end of the kiln.

Thus, the kiln operation is equipped with instruments for the utmost in control of firing conditions. The cooler and coal mill operations are completely automatic and draft control is also automatic.

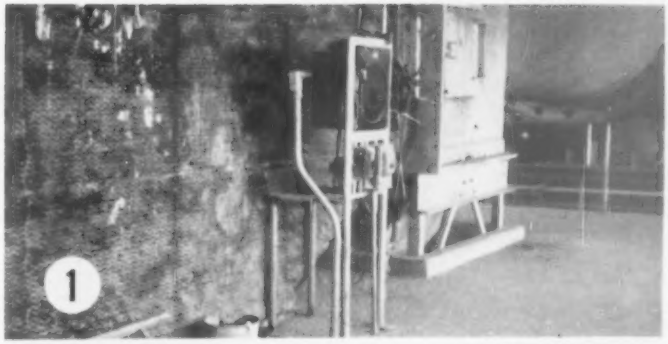
Finish Grinding

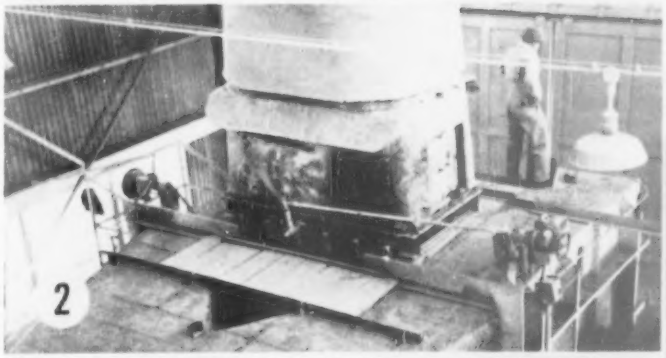
Finish grinding capacity has been increased to 9000 bbl. a day with addition of two 7- x 26-ft., 2-compartment A-C compeb mills which are identical to the four older mills. Each of the six can grind 65-70 bbl. of standard portland cement clinker per hr. to 1750-1850 sq. in. per gram surface area.

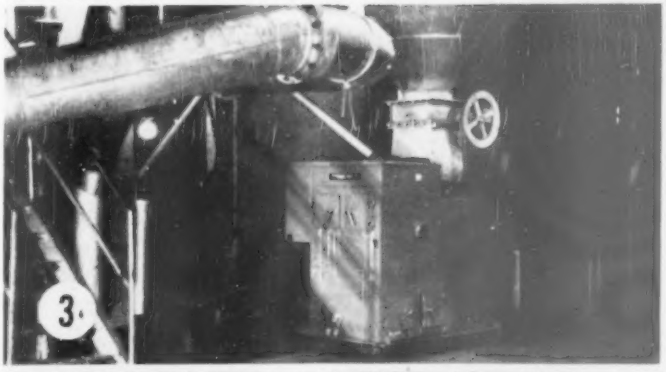
Clinker and gypsum are proportioned into each of the new mills by a pair of 36-in. x 9-ft. 8-in. Merrick type WS Feedoweights. The mills have drumfeeders and are driven by 500-hp., 200 r.p.m. synchronous motors (2300 v.) through Cutler-Hammer magnetic clutches. They have high pressure lubricating systems for the main bearings so that the mills may be "floated" when started to reduce the load on the drives.

Each mill carries a ball charge of 98,000 lb. of forged steel grinding media. Loading in the short 7-ft. first compartments consists of 7500 lb. of 4-in. balls, 6800 lb. of 3½-in., 4900 lb. of 3-in., 4900 lb. of 2½-in. and 2900 lb. of 2-in. balls. Second compartment loading is 71,000 lb. of 1¼-in. forged steel concavex media.

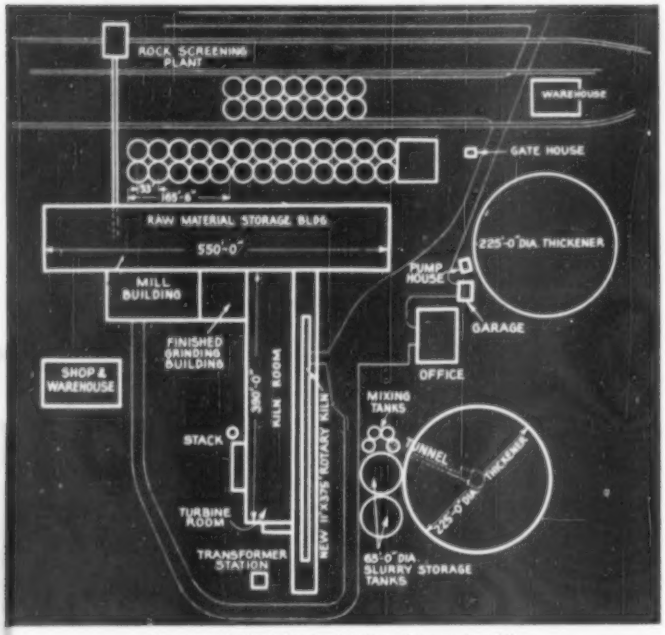
Each mill is closed-circuited with a 16-ft. Sturtevant mechanical air separator. Rejects are returned into the second compartment of the mill. Each new grinding circuit has a 15-ft. Norblo automatic bag-type dust collector







RIGHT —
(1) Continuous oxygen analyzer at exit end of kiln. (2) Louvre damper at exit of kiln has air and electric drives for optional use. (3) Coal feed into coal mill is regulated by this batching scale which operates automatically. (4) Air-operated damper is automatically adjusted to maintain air temperature into coal mill as measured by mill outlet temperature



Plan view of plant showing location of new rotary kiln

with air shakers in circuit with the system.

Cement is delivered into storage by an 8-in. Fuller-Kinyon pump. Storage capacity has been increased by 231,000 bbl. with addition of ten new hopper-ed-bottom silos, arranged in two rows, and four star bins. An 8-in. rail-mounted F-K pump under each row of silos is the means of transfer between silos, to the packhouse or to new bulk-loading facilities designed to load a 400-bbl. railroad car in 20 minutes. Transfer from the star bins to the pump is by Fuller-Huron airslides. The plant produces standard portland cement, high early strength portland cement, type II, air-entraining and masonry cements.

Slurry Handling

Raw mill output has been stepped up by increasing grinding operations from 25 mill hours to 44 (2 mills) per day to accommodate the increased kiln demands, but the slurry storage, blending and thickening capacity has been practically doubled not only to meet greater demands for slurry but to provide greater flexibility for mix control. Two 65-ft. diameter x 25-ft. high slurry mixing tanks were built for blending, added storage and to serve as kiln feed tanks. Each has a capacity of 7000 bbl. of slurry. They are equipped with Dorrco mechanical and air agitation. Thickener capacity was doubled by addition of a second 225-ft. diameter Dorr thickener. Flow of slurry into the thickeners is distributed radially by an Adams launder. All the old slurry tanks were torn out in rebuilding this part of the plant.

Feed of stone to the raw mill is usually minus ¾-in. limestone from the crushing and screening plant where large tonnages of commercial crushed stone and agricultural limestone are produced. Clay for mix correction is processed through a wash mill and then pumped into slip tanks from which it is gravity-fed to the grinding mills. Grinding is to 94 percent minus 200-mesh through two 7-x 26-ft. compeb mills which have been converted to tube mills and which are closed circuited with Dorr bowl classifiers.

Overflow from the classifiers is run by gravity into either thickener. Thickener underflow is pumped by 4-in. Wilfley high pressure slurry pumps, two to a thickener, into either of four 20-ft. diameter x 42-ft. high tanks for mixing and sampling. The mixing tanks have Minogue mechanical and air agitation, salvaged from the old tanks. Transfer into the large blending tanks is by gravity.

With this system, the mix is being prepared in one blending tank a day ahead for a full day's kiln feed, while drawing from the second blending tank to the ferris wheel feeder and filters. Usual practice is to carry slurry slightly low in $CaCO_3$ in one thickener, and slightly above the holding point in the other. They are fed slurry alternately according to shifts and depending upon demand.

Quarry

Quarry operations were not affected in the expansion and modernization program considered herein, but have been improved upon continuously over the years and represent efficient practice. Limestone is being delivered to the crushing and screening plant at

Mixing of the castable is done inside the kiln

a cost that is remarkably low for the industry by virtue of the short haul and the care exercised in eliminating bottlenecks to production.

The quarry is close to the plant, requiring a round-trip haul of only about 0.3 mile by truck. There is no grade. It is a two-level operation due to the cut being through two formations of different physical and chemical characteristics which have a natural parting. The upper layer, identified as the Cedar Valley formation, is softer than the Davenport limestone below and has no value for commercial crushed stone. Davenport limestone is higher in $CaCO_3$ but both formations are suitable for cement manufacture.

The lower face is fairly uniform in height over the level quarry floor and varies from 45-47 ft. However, the upper face, which is worked 45 ft. back from the face of the lower bench, increases in height from 32 to 72 ft. from the south toward the north.

Clay stripped by a Koehring dragline and P&H dragline is used for mix correction in the raw mill. Drill holes are driven by two diesel-powered and two electrically-driven 29-T Bucyrus-Erie well drills to 8-in. diameter.

Excavating equipment consists of two Marion $2\frac{1}{2}$-cu. yd. electric shovels, a Bucyrus-Erie 50-B 2-cu. yd. shovel, and a 4-cu. yd. 1400 P&H electric shovel added in 1947. The latter machine is used on the upper level to cast over stone for rehandling on the quarry floor by the other shovels.

When the conversion to truck haul was made in 1939, the 42-in. McCully gyratory primary crusher was located on the quarry floor for direct feed without elevation. Its output is elevated by belt conveyor to a scalping screen and put through reduction crushers for transfer by inclined belt conveyor to the screen house.

Transportation equipment consists of four Easton semi-trailer side-dump units drawn by four International KR11 motive units hauling 15 tons to the load. A recording ammeter on the crusher drive is an effective means of determining the causes for production delays and is used as a guide to corrective measures.

Power

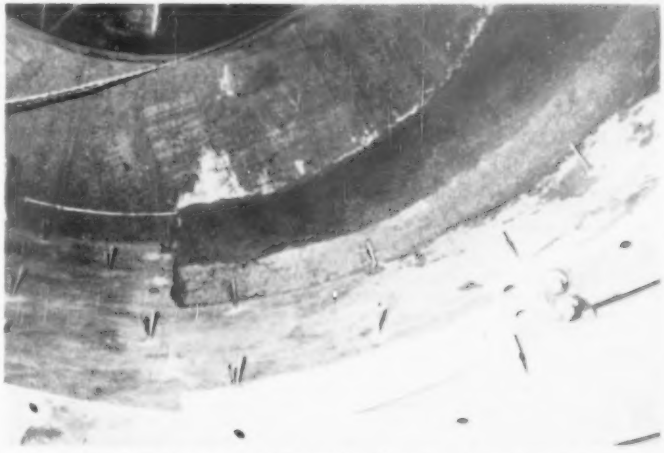
Power had been supplied in part by waste heat from the three older kilns and by two auxiliary stoker-fired boilers, with supplemental purchased power due to the heavy demands of the quarry and crushed stone operations. With addition of the new kiln and other equipment, arrangement has had to be made for more purchased electric power. The long kiln installation necessitated installation of two 150 kw. d-c generators. A bank of transformers, capacity 4500 kv.a., was also required.

Contractors

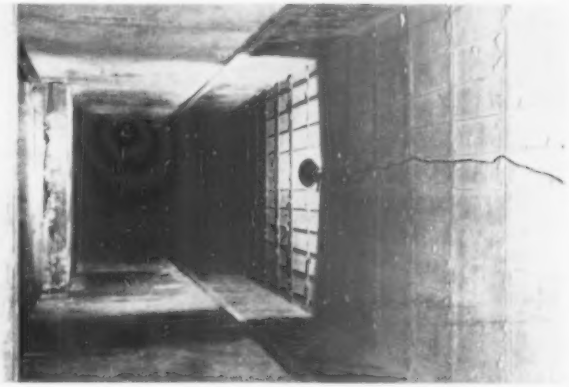
Crosby Construction Co., Chicago, Ill., was general contractor for the

(Continued on page 210)

Application of abrasion-resisting castable to main section of kiln



Shown here is use of abrasion resistant castable refractory, and the anchorage required



Stationary air housing, constructed of castable refractory, as viewed from discharge end inside clinker cooler

General plant view showing stores and repair shop, raw mix blending silo, mill house, cement silos and packing shed

Lepol Kiln Cuts Fuel Costs in South African Plant

Rhodesia Cement, Ltd., utilizes pneumatic conveyors for transport of fine materials; limestone quarried by gloryhole

By L. M. BAERVELDT*

THE DRY PROCESS CEMENT PLANT and the quarry of the Rhodesia Cement Ltd. have been laid out with the view of duplication at a later date. Thus adequate provisions have been made in the kiln and mill buildings for a second unit and the quarry plant has been designed to work only an 8-hr. shift at present. In case of an increase in output of the plant, the quarry would have to work an additional shift of 8 hr.

Charlie Dodd, general manager, explaining construction of kiln bearing to the Prime Minister, Sir Godfrey Huggins

The plant is situated on the high grade limestone deposit at Colleen Bawn (Southern Rhodesia) about 100 miles south of Bulawayo, on the railway line Bulawayo to West Nicholsen, and is served by 33,000-volt power lines from the Gwanda Power Station of the Electricity Supply Commission of Southern Rhodesia. The water supply is at present from boreholes and storage dams on the property, but water will be taken in the near future from the new Umzingwane dam about 9 miles away. The limestone hill is about 300 ft. high and about 500 ft. from the plant, the wall of the limestone deposit being shale suitable for cement manufacture.

In order to be certain that the correct grade of limestone is put into the crushers and from there directly into the raw material store, the quarry has been laid out on the "gloryhole" principle, which enables accurate and selective mining from any point of the hill. A main adit has been driven into the limestone hill from where drives branch off at right angles to the left and to the right. These drives have been equipped with suitable loading bins and rails.

At a distance of about 300 ft., gloryholes have been driven from the top level down to the main cross drive, a height of 110 ft. The quarrying is done on the individual levels about 110 ft. above each other. The rock blasted around the gloryhole is then conveyed to these 10-ft. dia. holes by scraper hoists, falls 100 ft. and is then collected by open "cocopan" trucks, hauled by a diesel locomotive

Pneumatic discharge valves discharging cement into air conveying troughs

*Director, Electro-Mechanical Construction Co., Johannesburg, South Africa.

and brought to the reinforced concrete receiving hopper outside on the slope of the hill. This hopper is situated above the Utah feeder which feeds to a 13-in. McCully crusher. The end product of this crusher is fed onto a short belt conveyor, then onto a vibrating screen which feeds a 4-ft. Symons cone crusher, all by gravity flow. The photo to right shows the reinforced concrete receiving hopper, McCully crusher, Symons crusher and belt conveying buildings.

This material, plus ½ in. minus ⅝ in., falls onto a 700-ft. belt conveyor which conveys the material downwards to the corner of the 400- x 70-ft. span raw material storage building, which is equipped with an "ASEA" overhead crane with a 7½-ton clamshell.

Belt conveyor, 700 ft. long, delivers to crushers. Reinforced concrete bunker and quarry compressor house can be seen in background

Raw Mill

The material coming from the belt conveyor also can be put directly into the feed bins of the raw mills, by means of two connecting conveyors. From these bins the limestone falls onto a No. 330 and the shale on a No. 220 Jeffrey vibrating feeder with Waytrol weighing mechanism, and is brought to a specially constructed E. M. C. raw mill called a "double rotator." This is 10 ft. in diameter x 24 ft. 6 in. long. It is equipped with a predrying compartment, a first compartment fed through the first trunnion and a second fine grinding compartment fed through the other trunnion. The common discharge is by means of cut-outs in the shell between the two dividing diaphragms. This peripheral discharge is brought to a bucket elevator which discharges into two Sturtevant air separators.

The rejects from the air separators are returned to either of the two compartments by means of a return screw for regrinding.

This mill is driven by a First Electric Corporation 600-hp. synchronous motor with .8 leading power factor, and is the same size motor as used for the cement grinding mill.

The E.M.C. "double rotator" is semi-airswept and connected to a Norblo cyclone for collection of the coarser dust particles and then to an E.M.C. bag-type collector. The mill is shown below.

The end product obtained from the cyclone, bag dust collector and the air separators is brought into 16-in. E. M. C. pneumatic conveyor troughs which are operated by small ventilators using only about 1/10 of the horsepower which would be required for other means of transport.

The material is then conveyed into either of the two double vessel E.M.C. *Cera* pumps, which convey the material to the three flat bottom raw material mixing silos, each 16 ft. 6 in. dia. x 60 ft. high. They are equipped with overflow indicators, pneumatic aerating tiles and pneumatic discharge valves.

In front of the silos run 20-in. conveying troughs in duplicate, enabling the operator to empty completely the silos to the last foot and to feed his raw mix to any of the Cera pumps for mixing or for direct conveying to the kiln feed silo.

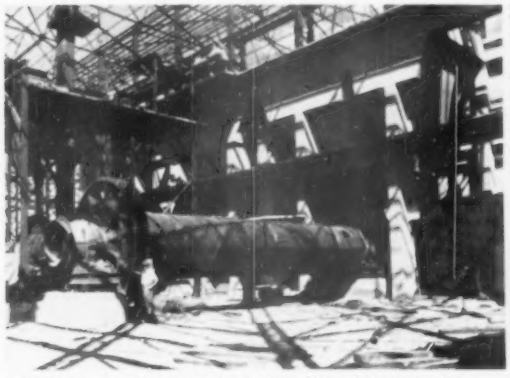
Nodulizing

The final raw material storage and kiln feed silo is 25 ft. 6 in. in diameter and 60 ft. high with a flat bottom. It is also equipped with aerating tiles, pneumatic conveying troughs and pneumatic discharge valves, all of which are operated by low pressure air. The raw material is then discharged into a bucket elevator feeding the small storage bin in front of the Lepol kiln Hydroballer which nodulizes the material.

The Hydroballer is 7 ft. 10 in. in diameter and 16 ft. 5 in. long, runs on two riding rings and is driven by a First Electric motor via a double reduction Benoni Engineering Works helical gear reducer.

The grate is 8 ft. wide and 45 ft. 11 in. long and connected to a Davidson-Brown exhaust fan in front of

(Continued on page 278)



Left: Three-compartment cement mill with additional air intakes between second and third compartments. Reinforced concrete feed bins and platform are seen in background. Right: Semi-airswept raw mill with bucket elevator and two air separators

JAPANESE CEMENT RESEARCH

THE FOURTH ANNUAL MEETING of Japan Cement Engineering Association was held in Tokyo May 8-12, 1950. On the first day 12 reports on technical cement research were given. The research work was mostly on chemical or mechanical improvements, or new plans for cement manufacturing, all of which are expected to contribute to the cement industry. In the remaining four days, 46 reports of research on cement and concrete were given. Those of interest to U. S. producers are presented here in abridged form.

Abnormal Setting Rates

1. Research on abnormal setting of portland cement. By R. Naito, Onoda Cement Co., Ltd.

As it is well known that setting of cement is due to the chemical reaction between cement compounds and water, in studying abnormal setting it is important at first to make clear the chemical reactions which would occur in the cement paste showing various sorts of abnormal setting, and then combine it with the theory of cement setting. For this purpose, the author made a close study of the composition of the liquid phase separated from cement paste during setting. By changing the water content in cement paste, he extracted the liquid and examined its composition. He also studied the abnormal setting of weathered cement, especially when the fineness of cement is very high.

Rapid SO_3 Determination

2. Rapid determination of SO_3 in cement by means of benzidine hydrochloride. By K. Noguchi and K. Taneda, Nippon Cement Co., Ltd.

Various methods have hitherto been proposed for rapid determination of SO_3 in cement, but there are very few acceptable. Applying the benzidine hydrochloride method to the determination of SO_3 in cement, the authors found it possible to obtain results accurate enough for mill control. The time required for determination is 1-2 hr.

Silica Cement

3. Study of silica cement (pozzolan-portland cement). By T. Yoshii and K. Kaneko, Chichibu Cement Co. Ltd.

Silica cement has been manufactured in the authors' plant for about 15 years. The caisson work for the foundation of Daiichi Sogo building at Hibiya, Tokyo, which is now General MacArthur's headquarters, was finished with the silica cement. The building was constructed about ten years ago and stands in direct contact with filthy water in the moat around the emperor's palace. The building is now one of the best constructed in Tokyo. In the present research, the authors chose three pozzolans; pumice, tuffaceous shale and conglomerate rock, which were mixed in various proportions and ground with cement in various fineness. The finished pozzolan-portland cements were tested for heat of hydration, water vs. air permeability, and sulfate resistance, and it was found that the cement of most desirable qualities can be obtained by adjusting the mixing proportion of pozzolans and the fineness of the finished cement.

Weathering of Cement

4. Research on weathering of portland cement. By K. Watanabe, Ube Kosan Cement Co., Ltd.

The author studied the weathering of portland cement in atmospheres of various humidities in a constant humidity chamber, examining changes in setting time, strength and fineness by weathering. The samples were further examined by means of heat balance. From the results of various tests he observed that the chemical reactions occuring in cement during weathering are as follows:

$$CaO + H_2O = Ca(OH)_2$$
$$Ca(OH)_2 + CO_2 = CaCO_3 + H_2O$$
$$3CaO{\cdot}SiO_2 + 3CaSO_4 + xH_2O = 3CaO{\cdot}SiO_2{\cdot}3CaSO_4{\cdot}xH_2O$$
$$3(3CaO{\cdot}SiO_2) + 6H_2O = 3(2CaO{\cdot}SiO_2{\cdot}H_2O) + 3\,Ca(OH)_2$$

Clinker Burning Mechanism

5. Research on burning mechanism of cement clinker in rotary kiln. By M. Okamoto and T. Shimizu, Nippon Cement Co., Ltd.

As a part of fundamental research on the burning mechanism of cement clinker, the velocity of burning was studied by determining free lime by microscopic observation. An electric furnace was used to burn the clinker. From the effect of burning temperature and time upon the burning velocity, the relation between two kinds of burning processes, the so-called "thick layer burning" and "thin layer burning" in rotary kilns was discussed. Ground raw cement was separated into several fractions of different particle size, and chemically analyzed. It was found that a comparatively big change in chemical composition exists in them. From the experiments it was found that fineness has a very big influence upon the burning velocity, and a small amount of coarse particles contained in raw clinker greatly delays the end of burning.

Hydration Products

6. Research on hydration of water-granulated blast furnace slag. By T. Yamanouchi and J. Mohri, Tokyo Technical University.

The hydration products of water-granulated blast furnace slag and lime were examined by means of a microscope, Kaisermann's dying method, refractive index and x-ray, and determined to be as follows: crystal of calcite, $4CaO{\cdot}Al_2O_3{\cdot}12\text{-}13H_2O$, $3CaO{\cdot}Al_2O_3{\cdot}8\text{-}12H_2O$, $3CaO{\cdot}Al_2O_3{\cdot}6H_2O$ (only in case of excess water) and a gel substance, whose composition is considered to be calcium hydrosilicate.

Gypsum-Slag Cement

7. Research on gypsum-slag cement. By S. Yokose, K. Motohashi and H. Hongo, Daiichi Cement Co., Ltd.

By simultaneous grinding of calcined gypsum and granulated slag with or without addition of under 15 percent clinker, various kinds of gypsum-slag cement were produced and examined. It was found that under certain conditions, both bending and compressive strengths can be as high as those of normal cement of high quality. Especially noticed was that the cement showed higher bending strength, and heat of hydration at 7 and 28 days was far lower than normal cement.

Hydraulic Properties

8. Research on hydraulic properties of water-granulated blast furnace slag. By T. Tanaka and K. Takemoto, Onoda Cement Co., Ltd.

The method of S. Michelsen (*Zement*, 1931) for determining the latent hydraulic power of granulated slag was used and the reaction mechanism of the method was studied. The method is carried out as follows: a small amount of fine ground slag is treated with a 2 percent solution of aluminum sulfate, and the time of first appearance of crystals, their time of growing and ultimate size are observed under the microscope. By means of chemical analysis and by determination of crystal angle and refractive index, the authors found that the method is fairly trustworthy. The formed crystal consists of hydrates of calcium sulfate. The method was further checked, using various sorts of sulfate salts.

Research on Fineness

9. Research on determination of fineness. By K. Chujo and S. Sekino, Nippon Cement Co., Ltd.

The values of specific surface of a portland cement determined by various methods, such as by the nitrogen absorption method, Wagner's turbidimeter method, Blaine's air permeability method, Lea-Nurse method and the air analysis method used by the authors, differ from one another very much, varying from 1400 to 8000 sq. cm./gm. The authors studied the reason why these divergences should occur, and tried to explain theoretically which value is the most reasonable for cement fineness. They concluded that specific surface obtained by air analyzer (standard type of Japan Cement Engineering Association) and Wagner's turbidimeter not only show closest values, but also the ratio between them is nearly always constant In addition, the specific surface by both methods is in most cases nearly proportional to the strength quality of cement. Therefore the authors feel that by the nature of cement these two methods are more rational for determination of cement fineness than are the others.

Determination of Fineness

10. Determination of fineness by means of turbidimeter and air permeability methods. By K. Matsuoka and M. Ueda, Onoda Cement Co., Ltd.

In the turbidimeter method, the determination of specific surface of fine powder has hitherto been made with the particle fraction of the minus 7.5 μ size. The authors tried to determine specific surface by dividing this into two groups 0-2.5 and 2.5-7.5.

After many experiments with air analyzing apparatus (standard type of J.C.E.A.) they found that Chujo's formula: R $(x)=e^{b}$", where R is weight of particle residue, and x is average two-axis diameter $(l+b/2)$, can be applied with quite good results. They also acknowledged that the specific surface obtained by Chujo by air analysis shows pretty good correspondence with the value of Wagner's turbidimeter obtained from two particle groups 0-2.5 and 2.5-7.5 μ. The authors also compared the specific surface of cement obtained by air analyzer (standard type), Wagner's turbidimeter and air permeability methods of Blaine and Lea-Nurse, and found that a definite relation exists between some of them.

Raw Material of Cement

11. Research on raw material of cement. By K. Chujo, G. Nemoto and S. Okajima, Nippon Cement Co., Ltd.

In three previous reports efforts were described to determine the natural property of cement raw materials and the effect of this property upon the burning of cement. In the present report the authors studied raw material fineness with the intention of changing the natural properties artificially.

Bending Strengths

12. Relation between water-cement ratio and bending strength of asbestos cement slate. By A. Iida, central laboratory of Nippon Cement Co., Ltd.

The author reported last year at the third general meeting on the relation between strength of gypsum-cement slate and cement strengths and fineness modulus of gypsum using Canadian chrysotile asbestos, and gave the following formula:

$$F = K f^{m} m P^{n}$$

where F is bending strength in kg./sq. cm. of asbestos-cement at the age of 28 days

f tensile strength of neat cement at 28 days

m fineness modulus of asbestos

P compressive strength of cement in kg./sq. cm. (1:3 mortar at 28 days as per JES 28)

n factor relating to mixing proportion of gypsum to cement

K constant depending upon the curing process. (In this case, moist air curing, K = 12.22) In the current report the author reported on the relation between water-cement ratio and other factors, and obtained the following equation:

$$F = \frac{K f^{\frac{x}{m}}}{(w/c)^{x}}$$

where F, f, m are the same as above

w/c water cement ratio in percent

x factor relating to the mixing proportion of gypsum

K constant (12.45 for moist air curing)

Cement Production

13. Cement production in 1949 and forecast for 1950. By S. Ito, Cement Manufacturers' Association.

Though the estimated yearly production for 1949 was 2,800,000 tons, it began to increase greatly last August with the relaxing of official controls on coal, so the fiscal year production amounted to 3,270,000 tons. The quality of coal for burning was at the same time greatly improved, which was very favorable on the cement quality. At present the demand for cement in Japan is estimated to be 4,200,000 tons while the hidden demand is greater than 3,000,000 tons more; the ultimate capacity for cement production is about 6,200,000 tons.

As both production and price controls on cement were removed on January 1, 1950, the 1950 production should perhaps exceed the effective demand slightly. Exports in 1949 did not reach the amount anticipated due to the devaluation of the English pound.

14. Research on light concrete by vacuum method. By K. Yoshida and K. Tamura, Waseda University.

The laboratory of Waseda university some years ago invented a new method of obtaining concrete of high porosity which has very excellent heat and soundproofing qualities.

The process is so carried out that the materials are cured in a vacuum tank during setting and hardening, and the air and moisture in the mortar and concrete are allowed to expand, while cement paste in the material is soft enough, to form bubbles of great size. These remain in the same state until the setting of cement ends. The material can be made in any form and size, and sawing and nailing are possible.

Colombia Cement Production

THE COLOMBIAN MINISTRY of Commerce and Industries has issued a resolution establishing cement quotas. The Ministry may cancel these export quotas and the licenses that have been issued, should speculation develop in the trade or should production be restricted. The largest quotas for the second half of 1949, that of 2000 tons monthly, was allotted to Cementos "El Caribe" of Baranquilla. The rest of the allotment, 1000 tons, went to Cementos Diamante of Bucaramanga. Because the increases for 1949 create a surplus over recorded consumption of 5600 tons monthly the Ministry deemed it wise to authorize the exportation of 50 percent of the surplus to permit the manufacturers to maintain normal output. The surplus exists, despite a booming construction industry.

It is estimated that the total Colombian cement production in 1948 was between 475,000 and 500,000 metric tons. Trade sources state that the industry planned to expand its production to 700,000 tons during 1949 and to about 1,000,000 tons during 1950.

Argentine Cement

ARGENTINE OUTPUT of cement in the first half of 1949 totaled 14,319,560 bags (of 50 kilograms), compared with 12,407,800 bags in 1948. Deliveries were 14,289,240 bags in 1949, compared with 12,041,850 bags in 1948, according to the Association of Manufacturers of Portland Cement.

Building permits issued in Buenos Aires for 1949 were valued at 545,000,000 pesos. Although this represented a substantial increase over the 1948 figure of 307,000,000 pesos, actual completion of construction was said to be lower chiefly because of the shortage of cement.

Production Of Blended Cement

By DR. STEVEN GOTTLIEB*

FIVE YEARS AGO a report was published[1] about a new type of blended cement in which particles coarser than 30 μ were replaced by a similarly graded inert material which had to be ground separately and mixed with very finely ground clinker. The original idea was to achieve savings by raising the capacity of the plant and economizing in fuel and labor. But practical experience with this cement, of which several hundred thousand tons were produced and used, brought such remarkable improvements in the quality of concrete, particularly in respect to durability, that it was decided to initiate a thorough laboratory investigation into the problem from a new angle, dealing primarily with the process of hydration and strength.

The new cement has been produced by preliminary crushing and grinding of clinker to the smallest possible particle size which could be achieved under practical conditions. The problem of special grinding has been given continuous attention for many years, and such degree of extreme fineness could be achieved that the resulting cement could no longer be regarded as suitable for practical use. Its water consumption became very high, it tended to lead to false or even flash set irrespective of the amount of gypsum added, and it agglomerated badly after short periods of storage in air. The clinker was of high quality with practically no free lime and negligible alkali contents.

There are also several other reasons why very excessive fineness renders cements unsuitable for practical use. Shrinkage and the rate of heat evolution are increased to such a degree that undue stresses in the resulting concrete cannot be avoided. Higher fineness increases the attraction forces between particles, rendering the handling and uniform hydration of such cements increasingly difficult. Furthermore, to justify the higher price of the very fine grinding, much less cement per unit volume of concrete would have to be used, thus involving requirements of aggregate grading and mixing which are generally unattainable on ordinary building sites.

If, however, immediately after leaving the mill, the finely ground clinker is blended with an inert material having suitable surface characteristics not only in respect to fineness but also as far as porosity and water absorption is concerned, the behavior of the resulting blend becomes quite different from that of the very finely ground clinker. The fine clinker when leaving the mill has a considerable electrostatic charge, preventing agglomeration for about 30-60 minutes, depending on the temperature of the grinding media, humidity and other factors. Therefore, if the blending with the inert matter is accomplished *immediately* after leaving the mill, it is possible to produce a very uniform blend.

The inert material had to be ground mainly in the 30-100 μ range, so as to complete the fineness curve of the very finely ground clinker, resulting in a particle size distribution very similar to that of portland cement in which, however, most of the coarser clinker particles (above 30 μ) appear to be replaced by inert particles. These particles intruded into the mass of the very small sized clinker particles, enlarging the average distances between them, which led to a considerable reduction of the forces of interparticle attraction. The great change in the behavior of the resulting "blended" cement was immediately noticeable in the handling operations: the flow of cement through chutes, out of silos, etc., became much easier.

The principle of the blend is illustrated by Fig. 1. Particle sizes are indicated on the log abscissa, while the ordinate gives percentages of amounts below the corresponding particle size, and also the "efficiency" of hydration, i.e., the percentage of hydrated clinker from the total.

One curve shows the particle size distribution of an average portland cement and the other curve its hydration efficiency. The figures as represented by the former curve were arrived at by a group of laboratory tests on the following limes: selected clinker with free lime content below 0.5 percent was selected for grinding under closely controlled conditions in a laboratory ball mill. No gypsum was added to the clinker. The particle size distribution of the resulting "cement" was checked in the sedimentation cylinder of Andreasen, in absolute alcohol with a small amount of $CaCl_2$ to prevent coagulation.

Table I shows the results of six selected grinding tests, in which sample No. 4 was found most suitable for further tests. In these, two samples of cement No. 4 were subjected to washing in absolute alcohol and by a series of decantations all particles above 40 μ were removed from one of the samples (4a). Nothing was removed from the other sample (4b) which differed from sample 4 only by having passed through a washing procedure with ab-

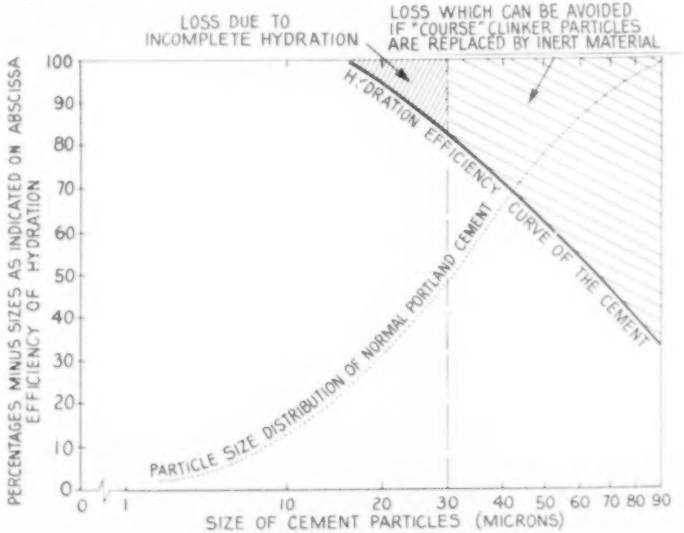


Fig. 1: Principle of the blend

*Queensland Cement and Lime Co., Darra-Brisbane, Queensland, Australia
[1]ROCK PRODUCTS, April, 1945, p. 181

solute alcohol. Heat of hydration on samples 4a and 4b was measured by heat of solution tests of the dried unhydrated samples, and on the hydrated and subsequently reground samples after three months of hardening.

For Table II the heat of solution figures were arrived at according to the method of Lerch & Bogue[2] using a solution of 2N nitric acid + 3 percent concentrated hydrofluoric acid. The method proved to be accurate to ± 1 cal./gm. Samples 4a and 4b yielded identical heat of solution figures of 629 cal./gm., proving that by separating the particles below 40 μ the change of chemical composition was insignificant. However, heat of hydration was very different, hydration of sample 4b being 17 percent more efficient than that of sample 4a for the period of three months. A second regrinding in a Vibro-type mill to great fineness and subsequent hydration proved that most of the cores which remained unhydrated during the first process became hydrated in the second, and there was practically no more heat of hydration after the third regrinding.

There are many conflicting reports in technical literature concerning the depth of penetration of water into the particles of cement and the whole issue deserves a comprehensive study in the light of recent research on hydration and hardening. Anderegg & Hubbell[3] found that storage in water at 21 deg. C. resulted in a depth of hydration of 0.5 μ in 24 hr., 1.7 μ in 7 days, 3.5 μ in 28 days and 5 μ in 90 days for a typical portland cement clinker between 15 and 30 μ in size. According to Schläpfer[4] a coat of gel envelops the grains of unhydrated cement, resulting in slowing down of the reaction.

Brown and Carlson[5] define hardened cement as "an amorphous mass where large amounts of unhydrated clinker grains are embedded." According to the classical theory of Michaelis relating to the hardening of cement, unhydrated kernels of cement have a definite function to perform in producing strength by "inner suction" of water from gel, surrounding the unhydrated kernels. Brownmiller[6] found that there is no microscopic evidence of channelling of water into the interior of cement particles to hydrate selectively any single major constituent. Hydration seems to proceed by the gradual reduction in the size of the particles as a function of the surface exposed.

The heat of hydration figures, as summarized in Fig. 1 and Table II, indicate conditions with a definite amount of water (20 percent of the cement). It is remarkable that another summary of results as shown in Table III, concerning strength tests, very closely follows the surface area and heat of hydration data, though the water-cement ratio in the 1:3 mortar is 0.44. It is hardly possible to give reliable figures of penetration on individual cement particles, as the rate of reaction starting on the surface will depend on the available concentration of water per unit surface. The efficiency curve of Fig. 1 indicates that hydration with 20 percent of water during three months storage under water of 20-23 deg. C. proceeded to an average depth of approximately 6 μ, but there is no reason why full hydration of all particles, irrespective of their sizes, could not have been achieved with more water. Actually, complete hydration with excess water has been proved by many investigators.[7]

On the other hand, it could be proved that notwithstanding the calculated average of 6 μ penetration after three months, some of the particles below 5 μ size were far from completing their hydration after 28 days. Table IV shows the results of alcoholic decantations on a selected clinker sample of high fineness; all particles below 5 μ have been removed from one of the samples, so the effect

Clinker: burned in a laboratory furnace.
C$_3$S = 59.4 percent C$_2$S = 20.4 percent C$_3$Al = 8.2 percent
C$_4$AlFe = 9 percent MgO = 1.52 percent CaOfree = 0.21 percent
Alkalies 0.6 percent

Grinding test No.	1	2	3	4	5	6
Spec. surface area Lea-Nurse method sq. cm./gm.	2944	3240	2880	3155	3420	3815
Sedimentation in abs. alcohol + 2 percent CaCl$_2$ Particles smaller than:						
2.5 μ (percent)				3		
5 μ (percent)				7		
20 μ (percent)	33.1 (*)	32	26	29	39.1	44
40 μ (percent)	45	45.8	43.6	50	57.2	61
80 μ (percent)	96	99.1	96	100	100	100

Sample No. 4 was selected for further experiments.

Table I: Laboratory grinding tests at various load charge ratios

A 2000 grams portion of sample No. 4 was subjected to ten washing procedures of 10 minutes each, with absolute alcohol, and ten series of decantations so timed according to Stokes' law that all particles below 40 μ could be removed (4a). Another 2000 grams of sample No. 4 were similarly treated, but without any removal of particles (4b).

Heat of solution tests according to the method of Lerch & Bogue:
Sample 4a 629, 628, 629, 631, 632 calories per gram
Sample 4b 633, 629, 628, 628, 628 calories per gram

Samples 4a and 4b were hydrated with 20 percent of water, and the specimen stored under water of 20-23 deg. C. for three months. The hardened samples were reground in a Vibratom mill, and tested for heat of solution:
4a 558 cal./gm. (of the dry substance)
4b 541 cal./gm. (of the dry substance)
thus heat of hydration during three months:
4a 71cal./gm.
4b 83 cal./gm. Difference = 17 percent

The reground samples were again hydrated with 20 percent of water (the paste was quick-setting) and the newly hardened specimen stored for another three months under water. (Slight deterioration near the edges was noticeable). After the second regrinding heat of solution was tested.
4a 520 cal./gm., thus heat of hydration during second storage = 38 cal./gm.
4b 516 cal./gm., thus heat of hydration during second storage = 25 cal./gm.
thus total heat of hydration for six months (in two stages):
4a 109 cal./gm.
4b 108 cal./gm.
There was no hardening after the third regrinding of the specimen.

Table II: Heat of hydration tests on sample No. 4

Specimen	LeChatelier soundness (mm.)	Bending strengths in kg./sq. cm. 1 day	3 days	7 days	28 days	90 days	Compressive Strength 1 day	3 days	7 days	28 days	90 days
4a	0	23.4	40	48.4	54.1	57	191	285	339	410	511
4b	0	29.6	50.6	59	66	68.2	134	355	406	494	622

Table III: Mechanical tests of samples 4a and 4b with the addition of 4 percent gypsum (Swiss Standard Specifications) 4- x 4- x 16-cm. beams, standard sand 1:3, 11 percent of water

Average clinker ground in the laboratory mill to 4370 sq. cm./gm. Lea-Nurse surface, was subjected to alcoholic decantation so timed to remove all particles below 5 μ size. The total amount of particles by weight thus removed was 4 percent.
Strength results according to Swiss Standard Specifications:

Specimen	Lea-Nurse specific surface (cm.^{2}/gm.)	Bending strengths in kg./sq. cm. 1 day	3 days	7 days	28 days	Compressive strength 1 day	3 days	7 days	28 days (water storage)
Original sample	4370	57	69.5	76	81.4	416	516	635	698
Particles below 5 μ removed	3758	48	57.1	64	69	373	451	571	631

Table IV: Influence of clinker particles below 5 μ on the mechanical properties of mortar

[2] P.C.A.F. research paper, 1934
[3] *Proceedings* A.S.T.M. 30 (1930)
[4] P. Symposium 270 (1940)
[5] *Proceedings* A.S.T.M. 36 (1936)
[6] A.C.I. *Journal*, January 1943
[7] Brownmiller, *Proceedings* A.S.T.M. 39 (1943)
Powers, P.C.A. Bulletin 22, p. 998 (1948)

Two different low-quality aggregate blends were used with heterogeneous cement brand "S" and rapid hardening portland cement, under strictly parallel conditions:

	Mixture A	Mixture B
1½-in. broken stone	54	52 percent
Stone of medium size	14	10 percent
Coarse sand	27	33 percent
Fine sand	5	5 percent
Cement	505	505 lb. per cu. yd.
Water/cement ratio	0.68	0.70
Slump, inches	3	3

Concrete slabs were subjected to hydraulic pressure increasing gradually in stages from 0.5 atm. to 3 atm. Each stage of pressure was maintained for 48 hr., and the amount of water percolating through was measured. The results:

Age at test	Mixture	Cement	0.5	1.0	1.5	3 atmospheres
3 months	A	rapid hardening portland cement	16	165	339	421 c.c.
3 months	A	heterogeneous brand "S"	nil	11	61	172 c.c.
3 months	B	rapid hardening portland cement	22	190	460	880 c.c.
3 months	B	heterogeneous brand "S"	nil	18	90	235 c.c.

Concrete cubes stored in continuously agitated sea water for two years, very lean mix, 1:12 by weight.

"S" cement concrete	56 kg./sq. cm., edges good
Rapid hardening portland concrete	31 kg./sq. cm., edges deteriorating

Identical concreting conditions.

Table V: Permeability tests

of particle sizes below 5 μ could be investigated. The decantation was a very long and intricate procedure and, unfortunately, there was not enough cement to be tested after three months.

But the results up to 28 days are instructive enough to prove that the particles below 5 μ have a definite strength-increasing effect up to 28 days, keeping more in conformity with the increase in surface than with that by their weight. The tests clearly demonstrate the great significance of active surface: a difference of only four percent by weight but 14 percent by surface produced an average increase of early strength by 15 percent, and 28 days strength by 11 percent. All strength tests were made in 1:3 proportion by weight basis with standard sand.

It is evident that the rate of hydration must slow down considerably after the first layer of water having the highest binding energy has struck the surface and released its heat of adsorption. According to the theory of Forsén[7] which appears well supported by experimental evidence, in the first stage $3CaO \cdot SiO_2$ goes into reaction in almost stoichiometric proportions with water, but instantaneously precipitates a less basic compound $2CaO \cdot SiO_2 \cdot 4H_2O$ in the sub-microcrystalline state, leaving a supersaturated lime solution. Normal hardening is the result of the continuous solution and precipitation of the above compound. These microcrystals are in a widely divided particle size range, dependent on the speed of precipitation and many other factors.

Each clinker compound has different characteristics as far as speed of solution and precipitation and average microcrystal size are concerned, hence their different values for the process of hardening. Precipitation is quickest in the presence of supersaturated lime solution, which explains the higher hydraulic value of C_3S in comparison to C_2S. Aluminates also react with water to form a series of hydrates, the solubility of which is also lowered by the supersaturated lime solution which makes them precipitate on the clinker grains in larger crystal sizes than $2CaO \cdot SiO_2 \cdot 4H_2O$. If alkalies are present, affecting the solubility of lime, the reactions and consequent crystallizations and crystal sizes may again be quite different.

During the period of normal setting the weak solid paste is held together by forces of interparticle attraction acting across thin films of water. When these films are in the process of being filled by microcrystals, the strength holding the paste together is increased.

Part of the microcrystal formation is definitely in the colloidal range, i.e., well below 200 $m\mu$, and has been described as "gel" for many years, but with the advanced technique, these "gels" have also been identified as microcrystalline.[8]

In the course of hydration and solidification, ultimately dense layers of microcrystals will surround the unhydrated particles, adsorbing considerable amounts of water on their very large active surface. But even "excess" water is held by adsorption forces residing on the crystal surfaces in consecutive layers based on the first, most strongly held, layer.[9] Thus it is clear that the concentration of microcrystals formed per unit volume of cement paste will have a great influence on the rate, i.e., the depth of reaction on the particles of cement. The increased density of the growing mass of microcrystals makes it more difficult for the remaining free water to attack unhydrated kernels of cement. Complete hydration would only be possible in the "ideal" state of dilution, necessitating large amounts of water which, however, would increase the average distance between the microcrystal surfaces and result in a decrease of the interparticle attraction forces. On the other hand, strength will mostly depend on these forces.

It is evident from the above that under practical conditions, we have to reckon with conflicting factors: to increase the rate of hydration, the amount of water should be increased, while by increasing the amount of water for the sake of more complete hydration of the larger particles, the interparticle attraction forces between the microcrystal surfaces are reduced. Optimum conditions from the point of view of strength will most probably be achieved with the largest possible concentration of smallest microcrystals, i.e., the largest active surface area, with about 2.7 *A.U.* space between surfaces, representing one adsorbed layer of water of one molecule thickness. Practically such an ideal condition is represented by the sharp peak of the water-cement ratio curve, also corresponding with the minimum paste porosity which cannot be reduced any more.

This view as expressed in the technical literature[10] is of high practical importance and served as a great support in producing "heterogeneous" cements* i.e., blended of clinker and inert material which replaces clinker particles in the "coarser" size range. It permits certain conclusions:

1) Ordinary portland cements of consistency practical for concreting have a low efficiency of hydration, and a fairly large percentage of cement remains unused in the form of unhydrated cores.
2) Interparticle attraction forces between the particles of cement must be reduced for promoting hydration, while the forces acting between microcrystals must be increased to promote solidification and strength. These requirements explain why it is impossible to achieve optimum hydration efficiency with "homogeneous" portland cements under

[7] Lecture, Symp. Stockholm
[8] Eitel, Z. f. ang. Chemie 185 (1941)
Katz et al., *Ind. & Eng. Chem.* 35:1178 (1943)
[9] Brunauer, Emmett, Teller, *J. Am. Chem. Soc.*, 60 (1938)
Harkins & Jura, *J. Am. Chem. Soc.* 66:919 (1944)
[10] Brownmiller, *Proceedings*, A.C.I., 1943
Powers, P.C.A. Bulletin 22, 1948
Werner & Glertz, Hedetrom, *Zement* 17 1928) and 30) (1941)

*By the term "heterogeneous" it is attempted to denote fundamental differences between the properties of two or more material constituents of the cement. Portland cement clinker is not, of course, heterogeneous chemically, but there is not much difference between the surface characteristics of its particles. Thus "heterogeneous" should be regarded as a practical term, to differentiate cements in which in addition to clinker and gypsum other non-hydraulic materials were included with a view to improving the quality of the resulting cement. Thus the term should not be confused with adulterated or extended cements.

practical concrete consistency conditions.

3) By increasing the average distance between clinker particles, but by filling these spaces with the largest possible concentration of smallest sized microcrystals, with only monomolecular water-layers between them, optimum strength and durability of concrete could be approached best.

The range of particle sizes and, consequently, also the resulting active surface forces, are very different for clinker particles and microcrystals. As derived from the equation of Brunauer, Emmett and Teller, the specific surface of microcrystals in the hardened state is

$(35.7 \times 10^4) \cdot V_m$ sq. cm. per gm.

where V_m is the BET constant = 0.027, while the specific surface of cement (clinker) particles in the extreme case is about 4×10^3 sq. cm. per gm.

The cavities between cement particles are thus much greater and less uniform than between microcrystals. This is also one of the reasons attraction forces between cement particles (causing agglomeration) increase the amount of water for a certain consistency.

On the other hand, the nearly total elimination of interparticle attraction forces between cement particles, as achieved by some dispersing agents, is of limited advantage as it could unfavorably affect plasticity.[7] The "medium" influence, as achieved by a slight increase of the average distance between the particles, due to the even intrusion of an inert material, is the best way to promote uniform hydration. Porous inert material having relatively small surface (in the coarse size range of about 40-200 μ) is of particular advantage, as it can slowly absorb excess water without affecting placeability of concrete, bringing microcrystal surfaces nearer to each other, and increasing their interparticle attraction.

Many requirements on the quality and particularly on the surface property of the inert material have to be fulfilled in order to suit the required purposes, as learned by many years of investigation and practical experience. Hardness and porosity are subjected to strict limitations and special methods of control were devised. Materials having low porosities (water repellent basalts, for instance) proved to be entirely unsuitable, similar to chalky limestones of high porosity.

Inert material of suitable porosity, evenly distributed between cement particles, will advantageously affect the curing conditions of the concrete. It absorbs water in its pores after withdrawing it from weaker held layers between the microcrystal surfaces, thus approaching the ideal monomolecular water layer. This observation is supported by Rhoades & Mielenz[8] who reported that during hydration or drying, while water is withdrawn from the interstices of the cement paste, water will be drawn by capillary attraction from aggregate particles containing only voids which are larger than those in the paste. This will result in less evaporable water remaining between surfaces, while the water-filled pores of the inert material act as reservoirs for further water requirements of continued hydration and curing.

Pores in hardened cement are generally termed as the space which may be occupied by evaporable water, i.e., water that exhibits a vapor pressure greater than 6×10^4 mm. Hg at 22 deg. C. Pores are thus capillary spaces which when distributed through the hydrated and hardened cement paste, weaken it and make it more susceptible to the intrusions of aggressive so-

[7] Powers, "The Consistency of Cement Paste," A.C.I. *Journal*, Vol. 41, November, 1945. See also W. Scripture: "Should Portland Cement be dispersed?" A.C.I. *Journal*, Vol. 42 December, 1946.

[8] A.C.I. *Journal*, June, 1946.

A typical "heterogeneous" cement, in comparison with a "homogeneous" rapid hardening portland cement, conditions of testing strictly identical.
"Heterogeneous" cement brand "S" containing 70 percent of clinker + 30 percent of inert material. (This cement had been produced at a rate of 600 tons per day, during 1944 and 1945 in Haifa.)

Cement	Residue 170 mesh percent	Spec. surface sq. cm./gm.	LaChatelier soundness mm.	Shrinkage in air storage Swiss standard beams, mm. per meter 7 days	28 days	2 months	3 months
"S"	10	4000	0.5	—0.26	—0.35	—0.41	—0.47
rapid hardening portland	4	2970	0.5	—0.27	—0.55	—0.58	—0.71

	Heat evolved during hardening (max. temp. deg. C. in vacuum vessel 300 gm. cement + 75 gm. water)	Swiss standard beams stored 28 days in water and subsequently for 5 months in 5 percent $MgSO_4$ sol. "infiltration" of solution measured (noticeable by changed color) and bending strength tested
"S"	59	inf. average 2 mm., bending strength 73.0 kg./sq. cm.
rapid hardening portland	77	inf. average 22 mm., bending strength 65.5 kg./sq. cm.

	British Standard Spec. tensile strength p.s.i. 1 day	3 days	7 days	28 days	5 mos.	Compressive Strength (Swiss St.) kg./sq. cm. 1 day	3 days	7 days	28 days	5 mos.
"S"	380	540	570	610	733	154	267	450	580	620
rapid hardening cement	343	492	523	597	660	90	220	419	511	560

Setting properties: normal

Table VI: Qualitative data

A cement pat sample, representing average production of April 27, 1919 in the cement works at Beocin, as shown by the records had the following quality data:

Fineness on 4903 mesh	Compression strength of 7- x 7-cm. cubes, 1:3 with standard sand (Hammer apparatus was used, 8 percent water added): 7 days	28 days	1 year (air storage)
18 percent residue	145	220	265 kg./sq. cm.

The soundness test was "satisfactory."

Hardened cement pats were available for regrinding in May, 1949. These were reground to pass 170-mesh sieve, and tested for compressive strength again. Compacting was done with the Bohrie hammer apparatus, 10 percent water was used and 5 percent of gypsum added. Strength of reground cement 1:3 was:

7 days: 186 28 days 271 1 year 230 kg./sq. cm.

Table VII: Regrinding of 80-year old hardened cement paste

Tested by Harry Stager Laboratory in London (1944) according to British Standard Specifications:

Tensile strengths p.s.i.	Compressive strengths p.s.i. compacted with the vibrating machine, 10 percent water
1 day: 400 3 days: 500	1 day: 1930 3 days: 4390

well above the requirements for rapid hardening cements.

Table VIII: Heterogeneous Cement Brand "S"

Mixes in plastic consistency were prepared with "S" and rapid hardening portland cements under uniform conditions, sand with a fineness modulus of 2.50 being used, 1 cement:4 sand (by weight); w/c = 0.65.
18- x 18- x 5-cm. tiles were prepared from each mix with each cement, kept in molds for 24 hr., one day in a moist cupboard and subsequently in water for 26 days.
The tests were carried out after 28 days by raising the pressure in increments of 5 meters per hour until the appearance of water on the side of the tile which is opposite to the inlet of water.

Results:

with cement "S"	with rapid hardening portland cement
80 meters	50 meters

Table IX: Water permeability tests of pavement concrete

Concrete sleepers were made under identical concreting conditions and prestressing, with two types of cement: rapid hardening portland cement brand "Record" and "heterogeneous" type brand "Szigma."

One hour after vibrating, the sleepers were heated by steam to 85 deg. C. and kept at this temperature for three hours. In another two hours room temperature was reached again.

Average compressive strength results on 12 sleepers:

with cement brand "Record"	386.5 kg./sq. cm.
with cement brand "Szigma"	439.1 kg./sq. cm.

Table X. Comparative tests on prestressed concrete sleepers

lutions. Upon evaporating their surplus water, these solutions cause crystallization with accompanying disruptive forces. Conditions will, however, become fundamentally different when most of the pores are within the particles of the inert material which would release its water only as a result of competing forces, thus hardly giving any chance for excess water to accumulate in newly formed pores of the paste. As the pores of the inert material become partly emptied, the vapor pressure of the remaining evaporable water will be reduced correspondingly.

There was every justification to conclude from the above that the new "heterogeneous" type cement would have a much higher resistance against water under pressure and against corrosive solutions. Large scale laboratory tests and practical results during the past few years confirmed this. Table V shows some remarkable comparative data. Experience with concrete in agitated sea water (concrete piers subjected to heavy seas) confirmed the remarkable superiority of heterogeneous cements in comparison to rapid hardening portland cement (see footnote on Table V). Table VI gives a general comparison of quality figures.

The presence and restraining effect of non-shrinking bodies embedded in the cement paste, as well as their influence on diminishing capillary spaces in the paste, reduces the shrinkage of heterogeneous cements. Reduction of heat evolution per unit volume of cement paste is a natural consequence of a uniformly distributed heat absorbent of considerable heat capacity.

This is one of the most important aspects warranting consideration of heterogeneous cements, in preference to "low-heat" cements for mass concrete constructions. To "buy" the advantage of low heat at the expense of strength in the early stages is not necessary, if means can be found to keep heat evolution and shrinkage low at high strength. Thus stresses occurring in the green concrete due to outside temperature changes and other reasons can safely be taken up without the danger of cracks.

Very interesting results were achieved by regrinding samples of 30 year old cement paste, produced by the Beocin Cement Works in 1919 (Table VII). This cement, which in its time had been considered above average as far as strength and grinding fineness were concerned, gave a higher strength figure at its second grinding, i.e., upon regrinding the hardened paste. The efficiency of hydration during 30 years of hardening in normal consistency thus was less than 50 percent.

All concrete construction undertaken with the heterogeneous type cement several years ago is in very good condition today. This differs from "normal" concrete, in that less energies are buried in it, and are not noticeable in any way. The photograph (Fig. 2) shows a revolutionary design of a hangar in Lydda, one of the first major structures carried out with the new cement in 1944. The concrete floor spans were poured into corrugated sheet forms. Due to the shortage of forms they had to be removed after 12 hr. of hardening and lifted into position by crane after 70 hr.

Extensive pavement projects have been carried out with heterogeneous cement very successfully. Many airfield runways were constructed with 30 percent of inert material in 1944. The inert material was instrumental in eliminating bleeding entirely, and thus prevented an increase of the w/c in the topmost layer of the pavement and the accompanying detrimental effects on strength and shrinkage. Parallel laboratory investigations of the cement used for this job showed remarkably improved resistance to water under slowly increased pressure (Table IX).

All the above results of the past seven years, achieved at many places in the Middle East and on the Continent, proved that the production of cement based on the new principle of "heterogeneity" does not merely represent savings in manufacture and concreting by eliminating "dead" energies, so far remaining unused in the larger clinker particles of hardened concrete. The results achieved in testing laboratories as well as in practice proved that a remarkable qualitative superiority can be achieved over "homogeneous" cements, as it became possible to utilize the advantages of greater surface to an increased extent.

When hardened heterogeneous cement and portland cement pastes are compared under the microscope, the difference is clearly visible at magnifications as low as 160x. The former has a dense and uniform structure while the latter shows many honeycombs.

Practical results with concrete pipes, manufactured with heterogeneous cement, have confirmed improved watertightness during the past years.

In 1946 heterogeneous cements produced on the principles as explained were introduced in Hungarian cement plants on a large scale.[3] Suitable inert materials were found at two places and the results surpassed expectations. Pavements and mass concrete construction were the first applications but new data could also be collected from applications in the prestressed concrete and asbestos cement industries.

Table X shows the results of comparative tests between rapid hardening portland cement and heterogeneous brand "Szigma" with 27 percent inert material, as expressed in the letter of the chief engineer of a prestressed railway sleeper manufacturing firm.

An interesting observation in the

(Continued on page 209)

[3] A. Bereczky, *Építőanyag*, January 1949

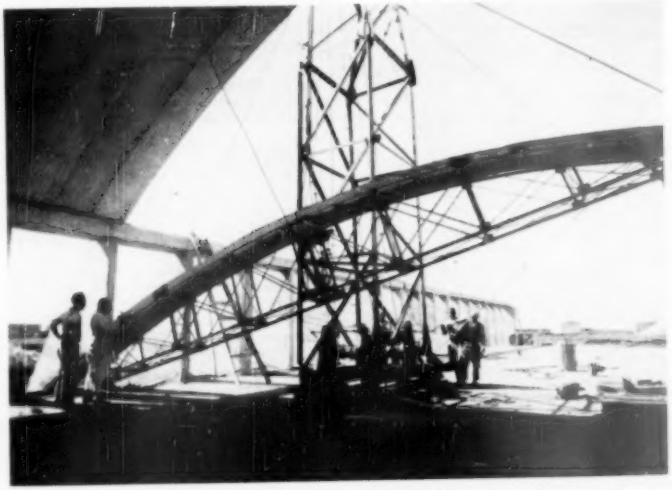


Fig. 2. Hangar in Lydda constructed of concrete using "heterogeneous-type" cement

The New Search for Fundamental Causes of Good and Bad Concrete

By NATHAN C. ROCKWOOD

READERS OF THE JUNE ISSUE of ROCK PRODUCTS, and the members and guests of the Portland Cement Association who attended the recent dedication ceremonies and were made familiar with the Association's new research laboratory, and have been briefed on the work its staff has outlined, know that a new era in cement and concrete research is dawning. It will include the kind of research that digs deep into fundamentals and requires the combined and coördinated efforts of many scientific workers who are specialists in the several branches of science. And it is directed by a scientist whose specialties have been geology, metallurgy and ceramics, rather than engineering. We have foreseen this event and have tried to prepare our readers through several articles suggesting the application of some of these sciences, that hitherto have not been closely studied in connection with the problems of concrete durability and concrete research in general.

To follow and understand the coming developments in concrete research is going to require more than the acquaintance with the simple inorganic chemistry and geology most of us who were educated as engineers were familiar with in high school and college text books and laboratories. We shall require some comprehension of colloid chemistry and of structural inorganic chemistry. One of our objects in those previous articles was to try to familiarize our readers with at least a few of the concepts of colloid chemistry. Much work has been done in this science by geological chemists or geochemists and physicists, and the colloidal properties of silica, alumina and iron oxide have been quite extensively studied. Some studies have been made of the colloidal properties of hydrated lime. Soil chemists or agronomists have studied the base or cation exchange phenomenon in clay soils, which should also throw light on the colloidal properties of cement and concrete.

Obviously, no one person can be an expert in all these sciences simultaneously. These articles that we have published in ROCK PRODUCTS, as stated several times before, are not intended as, nor could they possibly be, the opinions of an expert or designed to answer the unsolved problems of scientific research. They are based on extensive reading of scientific text books and they are designed to stir up an interest among other engineers, like ourselves, in sciences which we believe have been more or less neglected in concrete research. We suggested hypotheses and drew "conclusions" wherein such sciences may possibly apply. These have been doubted by experts in some instances, and with good reason probably, but have not been refuted because the necessary experimental data and theory to refute them have not yet been acquired by anyone. It makes little difference whether our hypotheses or theories are confirmed or refuted, because our objective is accomplished when we have helped to stimulate the search. In presenting our theories and "conclusions" it was specifically stated that they were presented "merely for discussion and suggestion" (page 112, ROCK PRODUCTS, December, 1949). That qualification should probably have been repeated in the second part of the paper published in the February, 1950, issue to avoid the misunderstanding that some readers have apparently placed upon it.

Research by Engineers

We had already sensed, what one qualified expert recently remarked to us, that much of the literature of so-called concrete research actually is little more than a voluminous collection of test data made usually for some special purpose, with conclusions based on the conditions of the particular investigation, and with no attempt made to fathom the underlying natural laws—chemical or physical—which may have accounted for the results revealed in the test data. Consequently, it is practically a hopeless task for anyone to attempt to digest and interpret this great volume of accumulated literature until the fundamental research in pure science now initiated is more or less completed. Then we think the accumulated literature on concrete research may prove of much greater value than anticipated.

One reason why developments in concrete research have been confusing is that they have followed a set path with little or no attention paid to these newer sciences, except by a few specialists, until very recently. Without any desire whatsoever to depreciate the efforts of engineers and constructors as research workers, we do think that their approach to research problems is not generally the kind that results in the development or discovery of new broad scientific fundamental laws or truths. We mean in the pure sciences of chemistry and physics. Of course, engineers have made and developed many broad scientific discoveries in the fundamental laws of mechanics as applied to design of structures.

The practicing civil engineer is a practical man. He is confronted with a problem of making concrete for a specific purpose. If the concrete does not serve his purpose as well as he thinks it should, he wants to know what is wrong. Is it the cement, the aggregates, the workmanship, the water-cement ratio, or some other factor he is familiar with? He immediately wants to eliminate the bad effects or the influence of that factor or factors.

The truly scientifically-minded researcher asks himself, what is this stuff we call concrete? What are *all* its chemical and physical properties that we can determine and how do they tie together? How does concrete differ from natural rocks? What is the real nature of the bond between the particles? What happens ultimately to the ingredients of cement when it is hydrated? When it ages? Is permeability a good or a bad property? etc. The scientific researcher, if he is free to pursue his search for the whole truth, is not especially interested in determining whether this cement, or that aggregate, is good or bad for a particular purpose. He wants to find out *why* it is apparently bad in one instance and good in another. And, we venture the opinion that the engineer, with his different, more practical approach, would never answer these questions, nor will the scientific assistants he employs answer them if their investigations are dominated by the engineers' point of view. The great truths of science have been established usually by researchers who had no utilitarian or commercial objective.

One engineer, at least, R. F. Blanks, U. S. Bureau of Reclamation, appears willing to admit what we have just stated, for he wrote in *Engineering*

News-Record, September 1, 1949: "The mass concrete problem, and other similar engineering problems, have developed because research and technical advancement have not kept pace with [engineering] practice. However, engineers are learning to use the technical tools of all sciences more completely and effectively and to seek the aid of their scientific friends." It might be well if engineers gave "their scientific friends" a free hand from now on; and waited patiently, maybe for several years, to get results, and not "jump the gun" with any more confusing cure-alls.

Research on Cement

Scientific specialists in pure science, both in this country and throughout the world, have given us a comprehensive knowledge of the ordinary chemistry of portland cement. Every one familiar with this literature has a fairly clear understanding of what the principal constituents of portland cement are under specially controlled laboratory conditions of preparation and processing, governing proportions of pure raw materials, temperatures and times of heating and cooling. When all these conditions have been fixed it has been made possible to compute the *probable* percentages of C_3S, C_2S, C_3A and C_4AF. But those specialists who have developed the formula also consistently warn the user that these analyses are approximate only, and that any change in any of the conditions can result in changing these percentages to an unknown extent.

For example, no one knows fully what effect mineralizers have on the fusion and phase relations (that is, on the melting and the order of recrystallization) of the clinker. Among such mineralizers are the alkali metals lithium, sodium and potassium, which are always present to some extent in all raw mixes. Perhaps the most important of all mineralizers is occluded water vapor and/or "water of constitution or crystallization," found in many natural minerals, including some forms of silica. It is the presence and sometimes concentrations of such mineralizers in the Earth's magmas which are held to account for the great variety of igneous rocks resulting from the cooling of magmas, that have about the same chemical composition. The art and science of using mineralizers to make desirable components in cement clinker remains to be discovered and developed.

There are all kinds of proof that differences in chemical and mineralogical composition cause differences in some of the physical properties of the cement. We have argued that in the final analysis it is only the physical properties of the cement or the mortar and concrete made with it that determine durability and other desired qualities in mortar and concrete. However, we shall not know the full significance of chemical analyses of cement until we know all the effects of chemical composition on all the physical properties of the hydrated cement. Of course, from experience and experiment, recorded in detail, we know some of these effects. We have yet to learn *why* chemical changes produce these physical effects. A study of the structural chemistry of hydrated cements will ultimately answer this.

We have argued, and we think justifiably, that engineer specification writers, lacking a comprehension of all that is involved, have placed too much confidence in chemical formulas. A paper by Myron A. Swayze, director of research of the Lone Star Cement Corp., published in the January and February, 1946 issues of the *American Journal of Science*, sustains our argument. Mr. Swayze, as people in the cement and concrete industries know, is one of the few scientists employed by a cement manufacturer who has done original research in pure science. His paper deals with the significance of the A/F (alumina-ferric oxide) ratio, which government engineer specification writers consider so important in the newer types of cement they claim to have originated to meet some of their special problems. Mr. Swayze shows that the A/F ratio as the means of determining the percentage of unwanted C_3A is not significant at all unless various possible phase relations of the clinker formation are taken into consideration at the same time.

This is so because the lime does not always combine according to the rules of the formula. As he states it: "The habit of C_3A is to crystallize rapidly in large units around grains of CaO. It also occludes [that is insulates] crystals of C_2S in a similar manner (Brown, 1937). In the present study, inclusions of periclase [MgO] by C_3A have also been noted frequently. Similarly C_2S crystals, formed during initial cooling [of the clinker] of overlimed mixes, have been observed by Brown, G. W. Ward (1941), and the writer to occlude free lime grains. Occlusion of C_2S grains by C_2S crystals in normal cement clinker is common to practically all portland cements.

"When occlusion of CaO or C_2S grains by C_3A occurs, these grains can no longer react with the liquids [in the clinker] surrounding their C_3A envelope, nor with new mineral grains formed during subsequent cooling which may not be compatible with them. The occluded grains are perfectly stable, being in contact with only C_3A, [which has its full quota of lime], while the exterior of their C_3A envelope in turn is stable in contact with the lower limed liquids, and new minerals formed during subsequent cooling. Hence, grains of CaO and C_2S occluded by C_3A must be considered protected phases." That means, as we understand it, the CaO both free and in C_2S and C_3A that should go into combination with lime-hungry other components in the clinker is prevented from doing so, and this throws off our calculated percentages of $3CaO{\cdot}SiO_2$, $2\ CaO{\cdot}SiO_2$, $3\ CaO{\cdot}Al_2O_3$ and $4\ CaO{\cdot}Al_2O_3{\cdot}Fe_2O_3$. It is possible to have various percentages of alumina in the raw mix without detrimental results, if the lime is free to combine with both alumina and iron oxide as $C_4A_xF_y$ (where $x+y=3$), or those lime-alumina-iron oxide minerals which are not detrimental, instead of in C_3A, or as free CaO, which are detrimental. In this way he accounts for the differences in resistance of concrete in sulphate solutions even when the alumina content may be the same.

There is one other quotation from Mr. Swayze's paper that further substantiates our previously expressed point that too much reliance is placed by specification writers on the calculated compositions of portland cements. He writes: "In commercial burning, equilibrium conditions cannot be assumed, either on the heating or cooling side of the cycle, except under unusual conditions of composition and character of raw materials. Alumina and iron oxide will liquefy rapidly, carrying with them sufficient lime and silica to form the characteristic liquid component of the mix. However, combination of the residual lime and silica must depend on their original state of subdivision, amount of liquid present, temperature of burning and time."

This study, Mr. Swayze believes, shows that the U. S. Government's specification's minimum limit on the alumina-iron oxide ratio of 0.64 is "not only needlessly restrictive, but to some extent defeats the primary aims in specifications for moderate heat, low heat and sulphate-resistant cements." He believes the ratio could safely be at least 0.32. We think that verifies an opinion expressed in a previous article that engineer specification writers have gone off the deep end in attempting to tell cement manufacturers what their cement should be composed of, and that they would get better cement if they left the composition up to the manufacturer and insisted only on the physical properties they desire. (Remember, however, *we* are saying that, not Mr. Swayze).

There are, of course, other factors than the chemical composition of the cement which affect or determine the physical properties of the hardened cement paste. There is the water-cement ratio, the fineness of grind, the distribution of particle sizes, etc. Some experts believe that the chemical composition is a minor factor. Be that as subsequent research shall show, the fact remains that excellent hydraulic cements were made before we knew anything about phase relations, or even before the raw materials were burned hard enough to develop any

liquidity. Cements like that used in the famous Bellefontaine, Ohio, pavement were called portland cement, but they would not come within a mile of meeting present-day specifications for portland cement.

However, we sympathize with cement company officers who indignantly reject any suggestion that the industry return to such slow-acting old cements. We have not intended to infer that they should. But, those old cements apparently did have some virtues that some present-day portland cements appear to lack. Of course, we can't conclude that the lasting qualities of some old concrete were due solely to the character of the cement used. However, at least there was no deterioration that could be attributed to the cement. As we have written before, we believe aggregates and mixtures have changed less in 40 or 50 years than has the character of the cement itself. But that again is an opinion, which only experts can answer, and we believe they are preparing an answer. The point is not that it is necessary to return to the old type cements, but true scientific research should try to find out what their special virtues were, if any, and *why*.

Colloidal Theories

Probably, in the opinion of many readers, our hypotheses on how lime accounted for the colloidal nature of the cement paste and its syneresis or setting and hardening seem the most farfetched. We think that is because many of these critics are unfamiliar with the recent literature on colloid chemistry. It is a relatively new science and there is a great deal yet to be learned. At the moment these suggestions of ours can be criticized only either as logical or illogical. The colloidal chemistry of silica, alumina and iron oxide, however, have been quite extensively investigated by experts in other industries, as in the manufacture of silicones, petroleum cracking catalyzers, ceramics, etc. In the case of hydrated portland cement, mortar and concrete, the field is wide open for new and important discoveries. The part of hydrated cement that forms gel is probably fundamentally one or more of these silica, alumina and iron oxide gels, either as a mixture or as a composite gel. Whether or not hydrated lime occurs in hydrated cement as a gel is not known, nor is the nature of the hydrated calcium silicates known. They are not known to geologists either because they are very rare or nonexistent in nature.

The study of the colloidal or physical properties of cement pastes, of course, has not been neglected. The Portland Cement Association has done much research on such properties of hardened cement paste as determination of its permeability and porosity, and the relation of these to freezing and thawing resistance. Also, under the P.C.A. fellowship at the National Bureau of Standards research is in progress to determine the sizes of pores and capillaries in hardened cement pastes. The related study of the porosity of coarse aggregates has been carried on to some extent in other laboratories. There is already enough data to sustain our theory that the kind, size and volume of porosity are very important factors in determining the durability of concrete, just as geologists have found them to be so in natural rocks.

It appears that air entrainment by providing numerous pores of relatively large size helps make hardened cement paste and concrete resistant to freezing and thawing, because these larger pores act as relief valves or reservoirs for water under pressure in the smaller pores and capillaries. According to the theory developed by T. C. Powers of the P.C.A. research staff, the water freezing inwards or downwards from the surface of the concrete forces the water ahead into the pores made by air entrainment. Hence these have to be located close enough together that the hydraulic pressures generated will not fracture the walls between. When the concrete drys out, the water returns to the smaller pores and capillaries.

However, not all the water in the paste is considered "freezable." An arbitrary distinction is made between the water retained in the finest pores, and that which will permeate the paste into the air voids. Little is known of some of the physical properties of the water retained in the fine pores and capillaries, nor in fact of the properties of moisture in general under such conditions of forced retention in the finest pores of a mineral. In the smallest capillaries it is practically a solid, and in slightly larger ones viscous. It seems only logical to assume that this retained water may be subject to volume change caused by temperature change, and that it is because of this retained moisture, the high coefficients of expansion of hardened cement paste and such minerals as chert are accounted for.

At the National Bureau of Standards studies are being made of the size and amount of pore space in hardened cement pastes by adsorption of nitrogen, oxygen and argon at or near their boiling points. The adsorbing surface in these small pores and capillaries is much less when measured by these gases than for water vapor. The experimenters, R. L. Blaine and H. J. Valis, suggest that this is because the nitrogen molecule N_2 is slightly larger than the water molecule H_2O. But there is another factor, not discussed, that is, silica has a great affinity for adsorption of water, while it probably does not have any such affinity for an inert gas or liquid like nitrogen. Incidentally, it is this property of silica for preferential wetting with water, which displaces the adhesion of asphalt to silica aggregates and causes "stripping." The surfaces of silica are charged negatively by unsatisfied oxygen ions, as explained farther on.

Another interesting result of the Bureau of Standards study is the conclusion that the higher the temperature used to evacuate or dry out the paste, the greater the surface area shown by adsorption of the nitrogen. If the size of the pores and capillaries limits the amount of nitrogen adsorbed, because of the size of the nitrogen molecule, evidently the higher temperatures enlarge the pore and capillary openings. This is only another way of saying, as we have previously, that the cell walls of the paste shrink. We suggested that this was one reason why thoroughly dried porous aggregates, such as chert, often prove satisfactory, while saturated chert usually does not.

Our idea is that it is not the pore characteristics of the cement paste or of the aggregates alone which determine the durability of mortar or concrete, but the sum of their pore characteristics. Mathematically expressed: $P = p_c + p_f + p_a$, where P is the characteristic porosity of the concrete, p_c the characteristic porosity of the hardened cement paste, p_f the porosity of the fine aggregate and p_a the porosity of the coarse aggregate. The porosity of the mortar would then be $p_c + p_f$ and maybe, and in good mortar should be, something less than their arithmetical sum. This would account for the fact that the same coarse aggregates give a good account of themselves with some cements and some sands, but give poor service with others.

We have suggested that the porosity of concrete may have been determined by the character of the cement, and that some of the "good old cement" was good because it was coarser ground, had better particle size gradation, and contained less C-S. It is just as possible, of course, that an excess of fine porosity was avoided by dryer mixes, accidentally entrained air, coarser sand, or ill-graded sand, or some other reason. If enough air-entrained voids are all that is necessary to provide resistance to freezing and thawing, probably it does not make a great deal of difference how the voids are made so long as there are enough of them and they are disconnected, of the right size and properly spaced to serve the purpose. Eventually, however, all such voids may fill up with the "solution products" of the hydrating cement. If the capillaries fill up at the same time, we could get eventually "impermeable concrete."

Structural Chemistry

The research work to be undertaken by the Portland Cement Association, we understand, will include a study of the crystal structures of cement hy-

(Continued on page 216)

Committee C-1 on Cement, American Society for Testing Materials, at 53rd annual meeting held June 28 in Atlantic City, N. J.

Cement Committee Members Honored at A.S.T.M. Meeting

THE 53RD ANNUAL MEETING of the American Society for Testing Materials, Atlantic City, N. J., June 26-30, held a little human interest for committee members in cement, concrete and aggregates, in addition to routine reports on testing and research. Two long-time members of Committee C-1 on Cement were awarded Honorary Life Memberships in recognition of their services to the society over many years. They are P. H. Bates, former head of the silicate products division of the National Bureau of Standards and for many years chairman of Committee C-1, and W. C. Hanna, chief chemist of the California Portland Cement Co., a prolific author of reports and contributions which have been helpful in the work of Committees C-1 and C-9 on Concrete and Concrete Aggregates. Special recognition was also given to William H. Klein, vice-president, Lawrence Portland Cement Co., and A. T. Goldbeck, director of research, National Crushed Stone Association, for completing 40 years of active membership.

Cement Report

Most of the activities of Committee C-1 on Cement were referred to as "progress reports." There is a great deal of interest in pozzolan cements, and one by one, portland cement manufacturers are either producing them or getting ready to. The market seems assured as a result of U. S. Bureau of Reclamation experience. The chief stumbling block now appears to be the writing of a specification for pozzolanic materials. Another item of more than usual current interest is determination of the optimum amount of gypsum in portland cement for durability. Most of the rest of the report of Committee C-1 had to do with slight changes in specifications.

New tentative specifications were adopted for "Air-entraining additions for use in the manufacture of air-entraining portland cement—C226-50T"; and tentative methods of test for "Potential alkali reactivity of cement-aggregate combinations — C227-50T." Also reported by the committee was a proposed "Tentative method of test for bleeding of cement pastes and mortars—C00-50T." There were no papers at the general sessions of the society of specific interest to cement manufacturers. There was a symposium on soils, which some day may throw more light on cement and concrete relationships, but at this stage the sciences of soil physics and mechanics and concrete physics and mechanics are far apart.

Concrete Reports

The report of Committee C-9 on Concrete and Concrete Aggregates was brief and contained nothing novel. However, there is a movement within the committee to write new specifications for aggregates which will contain more or less definite limitations on such things as percentages of deleterious substances. The present specifications are very open because it was early recognized that it would be difficult to write specifications for nation-wide use of very diversified natural materials. The result is that these specifications contain gaps that the local user is expected to fill in to meet local conditions. Many users consider this a very inadequate method of meeting a demand for usable specifications.

The chemical reactions between cement and aggregates (usually referred to as alkali reactivity) are still a center of attention, but there was not much new to contribute to the already voluminous literature on the subject. W. C. Hanna, chairman of the joint subcommittee of both C-1 and C-9 which is investigating this subject, stated in his report: "The aggregates as well as the cement sometimes undergo chemical reactions within the concrete, which may be beneficial in that they may increase the strength or may be detrimental in causing undue expansion and pattern cracking in the concrete."

If the reader of this convention report thinks we have been unduly critical of the efforts of engineers as research experts elsewhere in this issue, it is believed the following quotation from C. H. Scholer's report as chairman of the subcommittee on durability of concrete may be more convincing. For, after more than 40 years of engineer research on concrete, Prof. Scholar says: "Some of the questions that should be answered are:

"1. What is the mechanism which causes the failure of portland cement concrete under normal outdoor exposure to weathering action?

"2. What characteristics of the cement and aggregate, physical and chemical, affect resistance to weathering?

"3. What are the effects of construction practices, handling, placing, finishing and curing upon concrete durability?

"4. What are the chemical and physical reactions which cause concrete failure with certain cement-aggregate combinations?

"It is important that tests for all types of durability be developed."

Probably, no one will disagree with Prof. Scholer, but a skeptic might innocently ask, what have we been doing the last 40 years?

A new technique for testing the soundness of concrete in place was described by J. R. Leslie, research engi-

neer, The Hydro-Electric Power Commission of Ontario, Canada. The title of his paper is: "Pulse techniques applied to dynamic testing," and it describes the use of a pulsating instrument known as a Soniscope. By this method the velocity of propagation of an acoustical pulse through the material is measured. The pulse velocity so obtained is unaffected by size or shape of the specimen, and the elastic modulus may be calculated using one simple formula for all cases. An electronic pulse test set developed primarily for testing concrete structures in the field was described. The time of travel of the pulse is measured on a cathode ray tube using a strobe circuit and direct reading dial. More than two years' experience in testing laboratory specimens, for which it is now in regular use, were described. Mass concrete in the field has been tested for both deterioration and cracking; in one case many thousand readings were taken.

The curiosity of concrete aggregate producers as to how petrology is actually applied in determining the qualities of aggregates can be satisfied if they will read a paper contributed by Katharine and Bryant Mather, of the Concrete Research Division, Waterways Experiment Station, Corps of Engineers, U.S.A., entitled "Method of petrographic examination of aggregates for concrete." An appendix is especially valuable for it contains a list of rock and mineral names for use by concrete laboratory petrographers (and producers who want to know what the discussion is all about). Also included is a bibliography of some 55 titles for those who want to pursue a study of aggregate mineralogy.

Lime Burning

The only paper of interest to lime manufacturers was presented by J. A. Murray, H. C. Fischer and D. W. Saben, of the Massachusetts Institute of Technology. Mr. Murray was formerly a research chemist for the Warner Co., Philadelphia, Penn., manufacturer of lime. The title of the paper is "The effect of time and temperature of burning on the properties of quicklime prepared from calcite." The purpose was to determine the equality of the main constituent of limestones without impurities that always attend the burning of commercial limestones. The conclusions are:

"1. The porosity, surface area and activity of quicklimes prepared from calcite are closely related, high values of porosity are associated with high values of surface area and with high activity with water.

"2. With equal retention times in the kiln, higher temperatures of burning produce limes with lower porosity and activity. This effect is more pronounced at short retention times.

"3. An optimum retention time which produces highest porosity and activity may be found for each burning temperature.

"4. The rates of heating before and during calcination have a much greater effect on the porosity of quicklime than either the maximum temperature or the total retention time in the kiln subsequent to calcination."

Gypsum Report

Dr. L. S. Wells, National Bureau of Standards, chairman of Committee C-11 on Gypsum, reporting for the committee, listed numerous minor changes in standard specifications for gypsum products, which are largely changes in definitions and terminology.

Surface Waterproofing

Dr. F. O. Anderegg, director of building materials research, John B. Pierce Foundation, presented a paper on "Results on testing surface waterproofings." Probably the part of greatest interest to our readers has to do with waterproofing stucco and concrete block masonry. On this subject he said: "A great many million square yards of concrete block walls have been coated with stucco applied by hand, and when reasonably good materials and workmanship are employed good results have generally been obtained. Such ready-mixed materials as California Stucco have given good service through the years. However, application costs are rather high, so that attention has lately been turned to spraying. Three types of spraying equipment have been studied in this investigation:

"1. The materials mixed dry are placed in a hopper and drawn by a Venturi effect to the nozzle where the necessary water is added. Air under high pressure is required.

"2. A fine sand and a cement containing a stearate integral waterproofer and a little lime are mixed with just enough water to form a soft plastic mass which is introduced into a small hopper above a spray gun. The gun operates at about 15 p.s.i. pressure.

"3. The solids are suspended in a lot of water, are forced under pressure through a long hose to the spray nozzle where air under considerable pressure atomizes the suspension.

"Cinder block piers have been rendered tight by all three methods, at least after preliminary soaking periods. The second method is preferred as being most nearly foolproof, and both laboratory tests and field observations indicate that it is probably most capable of providing the best results. One limitation of spraying is that a rough surface is produced, much like stippling. Such a texture can be used to very good advantage over rough block masonry. It can be smoothed out with a small amount of effort, when a plane finish is desired. Another limitation lies in the spatter, similar to that produced in paint spraying. However, the speed of covering is sufficient to give spraying of thin coatings some economic advantage. All three methods can be applied to give grade A results.

"The sprayed-on stuccos seem to permit adequate breathing. The stucco applied by the second method and containing stearate waterproofer has resisted the tendency of sodium sulfate solution to form an efflorescent deposit in the laboratory but has not yet been tested on the roof (out of doors). This material and method have been developed in connection with a concrete block system which is laid up in a dry wall. The sprayed-on stucco serves to fill the joints, apparently far better than in orthodox walls laid up by most masons."

News Items

The present officers of Committees C-1, C-7, C-9 and C-11 were re-elected for two-year terms. Harry J. Love, of the National Slag Association, an honorary member of Committee C-9, presented the committee with $100, to be used $10 annually as an increment added to the Sanford E. Thompson Award for the most meritorious paper on concrete research. No award was made for the current year.

Cement in Angola

THE REPORT on cement in Angola given in *Mineral Trade Notes*, February, 1950 states that if the new cement mill there meets its anticipated production goal of 50,000 metric tons annually, it likely will not be necessary for Angola to import any cement. Only 48,033 tons entered the Colony in 1948. However, cement is on the list of "essential" items for which the Import Junta will grant permits for importation from dollar areas provided sufficient exchange is available. Imports of cement in 1947 totaled 39,288 metric tons. The greatest amount imported from any one country in 1948 was 32,797 metric tons from Belgium-Luxembourg.

Construction began at the end of 1948 on the first cement plant in Angola. This plant, which is located at Lobito, will be of great importance since heretofore it was necessary for the Colony to import all its cement.

The Companhia de Cimenta de Angola was first granted a charter in September, 1945. Construction is proceeding steadily, and the plant is expected to be completed in about two years. Initial production is expected to be about 60,000 metric tons annually, and will thereafter be increased to 150,000 tons. Coal, the fuel used, will be imported from the Union of South Africa. Sand and limestone will be obtained near the plant. Both vertical and rotary kilns will be used.

Empire Landing quarry and plant at Catalina Island. Plant is situated about half way up the mountain side

Graham Bros., Los Angeles, Calif., resumes operations on island with new, small-scale crushed stone plant, after lapse of many years. Emphasis is on large stone sizes shipped to mainland by barge

By WALTER B. LENHART

Catalina Island Stone Quarry

ONE OF THE MOST SIGNIFICANT rock products news items that has developed on the Pacific Coast during the past few months is that Graham Brothers, Inc., has returned to colorful Catalina Island and opened up a new quarry at Empire Landing. The new quarry is about 16 miles from the resort town of Avalon, the port of entry for the island.

The Graham brothers started in the rock business back in the days when horsedrawn vehicles were recognized as an efficient method of transportation. Their headquarters were on the new and fast growing Long Beach harbor, which, at that time, was being dredged from the swamps between the town of Long Beach and Wilmington. At the same time, the Wilmington and the San Pedro harbors were undergoing gigantic construction changes that eventually welded the three projects into essentially one harbor—the Los Angeles harbor—which has become one of the largest in the world. Some harbor authorities, when comparing the natural harbors of the world with the artificial harbor of Los Angeles, say it is like comparing a Neolithic cave dwelling with a modern streamlined structure. Be that as it may, the Los Angeles harbor leads the world in oil exports and imports of lumber, and for the United States has for the past five years led in fish canning. It is considered to be the second largest harbor in the United States, when ship tonnage and ship movements are weighed.

When large harbors like the Wilmington and Long Beach are dredged from the mud flats, stability must be obtained by massive concrete piers, sea walls of stone and riprap, stone breakwaters and similar structures. Tie these construction endeavors in with population growth un-paralleled in our history and one has a bird's eye picture of conditions in southern California at the time the Graham brothers started operations in the area.

Original Operation

The initial operation of the company, now know as Graham Brothers, Inc., was a quarry on the southern tip of Catalina Island near Pebbly beach. The rock was given a preliminary treatment on the island after which it was barged to the Long Beach harbor bunkers of the company for distribution. During the early 30's the company moved its headquarters and center of operation to El Monte where it built up one of the largest and most efficient sand and gravel operations in the United States. Once the El Monte plant got under way the quarry on Catalina Island was abandoned. However, the Long Beach bunkers and facilities were retained as a distribution center to serve that area. Now economic conditions are such that a new cycle of rock production has entered into the initial phases, and while the new operation of Graham Brothers on Catalina Island is a relatively modest one, compared to the older quarry or to the El Monte works, it is ear-marked with the typical Graham Brothers, Inc., flare for efficiency and low cost production.

John F. Pozar, quarry superintendent

All phases of the new operation are designed with the basic idea of low capital investment to be accompanied by production tonnages that will keep operation and transportation costs well in the low brackets. The Empire Landing quarry operation is keyed to a long range program, and this editor, having watched the growth of Graham Brothers, Inc., over the past 20 years, watched it from a closer viewpoint, and in more detail than probably any other rock operation in the United States. It is his foregone conclusion that, in the years to come, the Empire Landing quarry will take its place alongside the larger ones of the nation. The production from the new Catalina Island quarry will augment that of the El Monte plant

where the company's main office is located.

On the Atlantic seacoast harbors, a vast tonnage of sand, gravel, and crushed stone—even portland cement—is moved via water transportation methods, and distribution yards accompanied by ready-mixed concrete operations dot the various water fronts. The New York harbor and the ports adjoining it are good examples of clustered water-borne rock distribution facilities. The Los Angeles harbor is noteworthy because almost the opposite is true, for there is possibly only one operation other than Graham Brothers, Inc., that looks towards water-carried rock as a part of its transportation system. This condition probably has stemmed from the fact that good basic building materials near or abutting on the waters of the Pacific and in the immediate area are scarce. In addition, the major construction, when one considers the whole southern California area, has centered inland 20 miles or more and in areas where excellent sand and gravel is plentiful.

Geographical Features

Catalina Island is primarily a resort area and is the mecca of thousands of travelers each week. It is 21 miles long and covers about 48,000 acres, nearly 100 square miles. The town of Avalon is the port of entry for the bulk of the tourists, although an air strip is operated by the United Air Lines and is available only to their planes. The coastal areas of the island are the main points of interest, for there the marine gardens, deep sea and coastal fishing, and water sports are featured along with the island's balmy climate. The interior section of the island is used mainly by the Santa Catalina Island Co., which owns the island, to raise cattle. Any defacing of the coastal portions is frowned on and only such roads as are needed can be built, and these must be so located that people on crafts plying the adjoining waters cannot readily see the roads. If a road is built and later abandoned, it must be replanted and restored to its original status insofar as is possible. This also helps prevent erosion. Sanitation and its related problems have to be carried out in keeping with the best of modern practices. So operation of a quarry under such conditions presents problems.

This unit loads all rock at the quarry

Fresh water needs for the camp are at present being developed near the site. The crew will live in a camp being established near the quarry. All the homes were barged to Empire Landing, picked off the barges by a walking Monighan and then transported to the camp on a dolly powered by a D-8 Caterpillar tractor. Several modern 5-room staff houses were built near El Monte and carried on wheels to Graham Brothers, Inc., dock at Long Beach where the houses were completely furnished and then barged to the camp site.

Shipping

All rock from the new quarry will be shipped to the Los Angeles-Long Beach harbor areas by barges. These range in size from 900- to 1000-ton capacity. Some of them are company owned and others are leased. All are of wood construction. Tugs are hired. It takes from five to seven hours to tow a loaded barge to Long Beach, and from four to five hours for it to return empty.

The face of the quarry is several hundred feet high in some places and little or no overburden needs to be removed. An Ingersoll-Rand wagon drill is used for primary drilling, but the character of the material is such that very little primary drilling is needed. Jackhammers are used for secondary drilling and 20 percent Atlas WR extra explosives are used for the little blasting that is necessary. Air is supplied by a Gardner-Denver, Caterpillar-driven, portable compressor. The coyote system of blasting may be used later. Loading in the quarry is by a Northwest 80 shovel.

Loading of all material to the barges is accomplished by a Bucyrus-Erie walking Monighan that has a 135-ft. boom and slings a 6-cu. yd. dragline bucket from a 1⅝-in. drag cable. The dragline is diesel-driven with 140-p.s.i. air used for starting. The rig can lift a 20-ton piece of stone. For the larger pieces, chain slings are used. Loading of stone in most sizes can be done at the rate of 750 t.p.h. The walking Monighan rig was barged to Catalina Island from Hawaii.

All plant equipment is driven by electric power generated by General Motors Co. diesels. The set-up is quite novel, but efficient and consists of four diesels, 225 hp. each, assembled in essentially one drive unit with the assembled unit's crank-shaft extended and connected to a 500 kw. generator. The power plant came from a navy "quad" landing craft and it so functions that one or all four of the diesels can be cut in to supply power in proportion to the rock plant's needs. It burns a lightweight diesel oil. The power plant features Westinghouse controls.

The rock produced from the Em-

Truck dumps to grizzly that removes plus 12-in. rock and sends it to ground storage below. Some of the large pieces of riprap are seen in foreground

General views of Catalina plant. Crusher base, or minus 2-in. material, is stacked by short stacker belt, left. The 6- to 12-in. stone is scalped out on a grizzly at the top end of the inclined belt, right

pire Landing quarry is considered to be a diorite, a dark colored and relatively fine-grained material of magmatic origin. It is similar to the material processed at the older quarry, and is an aggregate that has, over the years, amply testified to its high quality, for there are few construction projects of "pre-earthquake" age in the city of Long Beach that material from Graham Brothers, Inc., did not figure in. The material in the quarry itself is such that a wide selectivity is possible. Certain zones are fractured and brecciated and from these areas, if so desired, the finer sizes of stone can be obtained. Other faces of rock are more massive in character and these can produce riprap and breakwater stone up to 12 to 15 tons in weight. Even in the fractured zones there are inclusions of non-fractured material that are massive enough to be used for breakwater stone and even these are associated with man-sized stone for the smaller sizes of riprap. With such a material Graham Brothers, Inc., has designed and installed a simple plant that makes it possible to process enough quarry-run material in enough sizes to meet current needs.

Sizes of rock processed and stockpiled are: (1) the big Class A rock weighing from 2-12 tons, (2) riprap from 2 tons in weight down to 12-in. stone, (3) minus 12 in., plus 6 in. The minus 6-in. material is all crushed for "crusher base" which is a minus 2-in. product that contains all the fines. It makes an excellent fill material and has high compaction qualities.

Recent developments in the Harbor areas of Los Angeles, as gauged from Los Angeles newspaper reports, relate to possible large and growing use for the crusher base run from Catalina Island because of a sinking of certain sections. Terminal Island, a relatively large island abutting on the Pacific Ocean between Long Beach and San Pedro, has some sections sunk in the 7- to 10-ft. ranges. This island has large industrial establishments as well as a large power generating plant, and many navy establishments. The sinking of sections of the island is attributed to dredging operations incidental to the deepening of adjoining water traffic channels, and/or to the extraction of vast amounts of oil from the sub-surface in that and adjoining areas. Regardless of the cause of the area sinking, it points to a continued and large use of fill material, and of larger riprap stone so as to help stabilize the area. The sinking has been at a slow rate and local authorities have the situation well under control. This paragraph is not to imply in any sense any sudden or possible catastrophe. In some parts of the harbor where piling is apt to be used, the 12-in. (top sized) stone is about the largest that can be used because of the difficulty of driving piling through areas blanketed with larger material.

The working face of the quarry at Empire Landing is well above high tides. Quarried rock is trucked a few hundred feet in two 30-ton capacity, rear-dump Sterling trucks to a heavy grizzly where the 12-in. (plus) material is removed and falls to a ground storage pile well below the plant, yet close enough to the water to be loaded to barges by the walking Monighan. The extra large sizes of stone are often sorted out and can be stored on the rim of the quarry floor and not sent over the grizzly. Two short belt conveyors that serve a second and smaller grizzly take off the 6- to 12-in. stone which falls to a storage pile alongside the one first mentioned. A rotary trommel screen is ahead of the 8- x 36-in. Pacific jaw crusher supplied by Alloy Steel and Metals Co. of Los Angeles. A set of 40-in. Pioneer rolls is used for further reduction when needed. The capacity of the entire plant is governed somewhat by the size and type of rock being quarried, but the crushing plant can handle 1000-1200 tons per 8-hr. day.

Officers

The head offices of Graham Brothers, Inc., are located at El Monte, California. Paul C. Graham is president of the company; Russell C. Graham is vice-president; L. I. Johnstone is vice-president in charge of sales; Charlton Dunn is production manager; Bert Blower is general superintendent of the Catalina operations; John F. Pozar, formerly of California Portland Cement Co. (Colton) is quarry superintendent, and Clyde Fouts is in charge of harbor unloading and water transportation.

Diesel-driven 500-kw. generator supplies power for the operation

This primary crusher is the only crusher used in semi-portable plant

IT COSTS LESS TO OWN THE BEST!

View From Kiln Feed Platform Between The Kilns

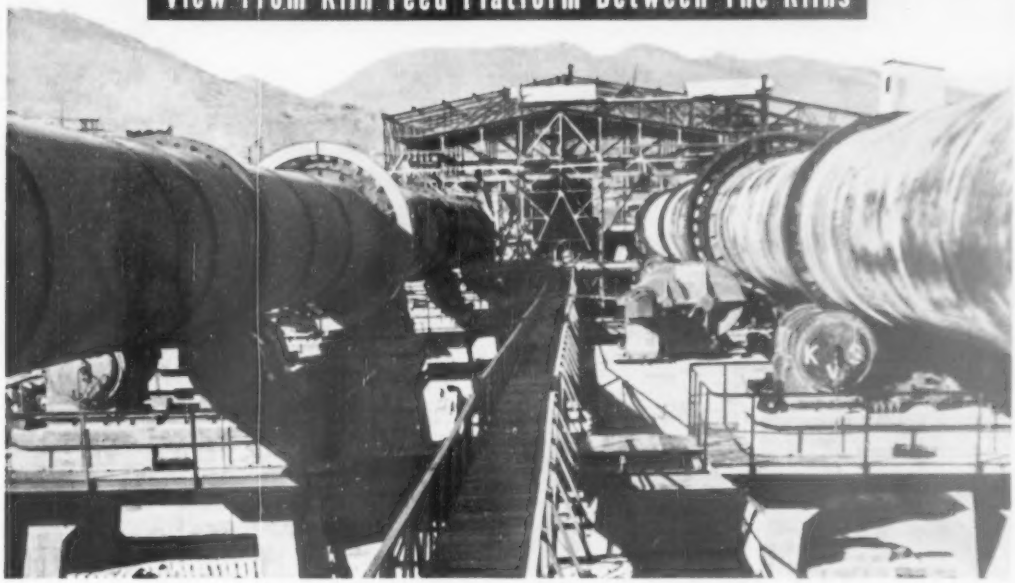


ILLUSTRATION SHOWS TWO LARGE KVS KILNS WITH SELF-ALIGNING BEARINGS

CAPACITY UNLIMITED!

KENNEDY KILNS ARE BUILT TO LAST

featuring:

ALL-WELDED SHELLS WITH SPECIAL THICK SECTION UNDER TIRES

CARRYING ROLLERS MOUNTED IN OVERSIZE SELF-ALIGNING BEARING TO GIVE LOW SPECIFIC BEARING PRESSURE.

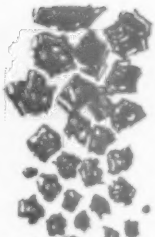
Let a KVS engineer review your plant needs and recommend the proper design and size kiln to meet your needs. Long life and dependable service distinguish all KVS products. It's the users who say "It Costs Less To Own The Best."

Send for bulletin describing KVS Kilns, Coolers and Dryers

KENNEDY-VAN SAUN MFG. & ENG. CORPORATION

2 PARK AVENUE • NEW YORK 16, N. Y. FACTORY: DANVILLE, PA.

MAKING LITTLE ONES OUT OF BIG ONES



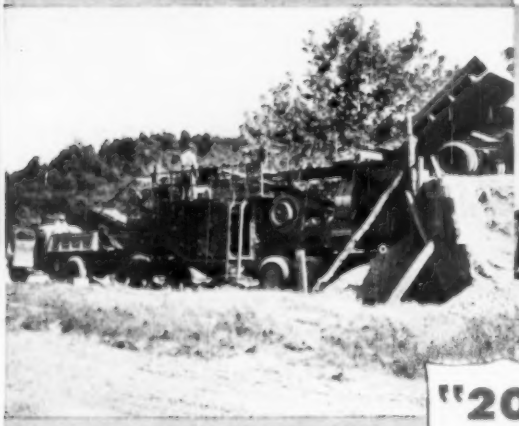
"61"

Designed for fast, economical production where extreme accuracy in grading to size is not required. Compact, lightweight and readily portable. Simple design and sturdy construction keep operating and maintenance costs at a minimum.

The AUSTIN-WESTERN LINE includes Jaw Crushers and Roll Crushers in a wide range of sizes; plus matching screens, elevators, conveyors and bins. Exclusive features increase output, assure constant operation and reduce maintenance costs. Skilled engineering characterizes each and every Austin-Western crushing, screening and washing plant, which is tailor-made to a particular production problem. We would welcome the opportunity to discuss yours.

AUSTIN-WESTERN COMPANY

Aurora, Illinois, U.S.A.



"201"

You'll like its READY PORTABILITY . . . CHOICE OF FEED . . . HIGH OUTPUT. The "201" is of a size and weight that can be transported over most highways without a special permit . . . may be had with either shovel-loading hopper, or swivel drive for separate feed conveyor . . . is capable of producing especially large amounts of ¾" and smaller product.

BUILDERS OF ROAD MACHINERY SINCE 1858

Austin Western

INFORMATION

You can obtain catalogs listed on these pages by merely checking and mailing the coupon below

TO HELP YOU MEET TODAY'S PROBLEMS AND TO MAKE PLANS FOR TOMORROW

1 AIR POWER—Compressed Air and Gas Institute, Committee on Engineering Education, has made available an 18-page booklet containing basic reference data on compressed air and gas power as applied to actual machines and uses. It is designed to aid students in all branches of engineering and is divided into three sections, namely, uses of compressed air; theory of compressed air; and types of compressors.

2 BELT CONVEYORS—Barber-Greene Co. has released 42-page Catalog RF on the Redi-Fab series of sectional truss belt conveyors for use in washing and screening plants, ready-mixed concrete plants, etc. Selection tables, specifications, instructions for laying out belt conveyor, and layout sheet of typical conveyor are also shown.

3 BELTING — Victor Balata & Textile Belting Co. has brought out a 4-page folder and price list describing the Suprene single textile belting for elevating and conveying requirements in handling all types of materials. Typical installations and specification chart are also given.

4 BONDING CEMENT—E. L. Lavino & Co. has issued a 4-page bulletin, D-117-A, explaining the composition, properties and applications of Kromepatch chrome bonding cement for use in blast furnaces, cement kilns, cupolas, lime kilns, recuperators, slag melting furnaces, etc.

5 BRAKE LININGS—Grey-Rock Division, Raybestos-Manhattan, Inc. has issued an industrial friction material catalog, No. I-102, covering brake linings and clutch facings for shovels, draglines, cranes, tractors, etc. Various types of friction materials are illustrated and described. Size data and recommendations, type of brake band with which units are equipped, equipment manufacturers part numbers, etc., are also included.

6 CLASSIFIERS—Hardinge Co., Inc. Bulletin 39-B describes and illustrates wet classification and heavy-media separation devices such as the counter-current classifier, counter-current heavy-media separator, heavy-media densifier, hydro-classifier, and the hydro-separator. Construction details, specifications, operational diagrams and flowsheets are also included.

7 CLINKER BREAKER—Fuller Co. has released Bulletin CB-1, describing and illustrating the clinker breaker which is designed for application to the inclined-grate cooler, to break up larger or oversize pieces of clinker, coating, or ring material, before discharging them from the cooler. Typical installations and diagrams are shown.

8 CLUTCHES—Automatic Steel Products, Inc. has issued three bulletins on its complete line of Mercury clutches for use on centrifuges, compressors, concrete machinery, conveyors, etc. Bulletin 216 describes Types R and C clutches; Bulletin 217 deals with Series G clutches applied to gasoline engines; and Bulletin 218 covers Series E clutches for electric motor applications. Dimensions and selection charts are also given.

9 CONCRETE—Sika Chemical Corp. has issued a 12-page booklet giving detailed information and specifications on various types of compounds for concrete and masonry construction such as Plastiment, Sikacrete, AER, RFC, etc. Materials for coating, sealing, hardening and repair work on concrete and masonry are also discussed. Descriptions, specific uses and contributing properties of the various products are given.

10 CONCRETE VIBRATOR—Wyzenbeek & Staff, Inc. has announced the new No. 50V WYCO concrete vibrator catalog. Operating data and complete information on the vibrators and contractors grinders are included.

11 CONTROLLERS — Wheelco Instruments Co. has released Bulletin CH-1, describing and illustrating automatic combined time-temperature program controllers, known as Chronotrols, for use where materials or parts used in metal processing, laboratories, pilot plants, etc., require a predetermined heating and cooling cycle to insure product uniformity and minimize rejects.

12 CONTROLS—Link-Belt Co. has released an 8-page bulletin, No. 2349, describing and illustrating automatic speed controls for the P.I.V. variable speed drive. The controls are job-engineered for automatically controlling the output speed range of the P.I.V. and is available in four types—electronic, hydraulic, pneumatic, and mechanical.

13 CONVEYING SYSTEMS—Convair Corp. has issued Bulletin No. 103, describing and illustrating pneumatic conveying systems for carrying cement, gypsum, sand, feldspar, fluorspar, dolomite, etc., in a flow of air, or inert gas, through a piping system, utilizing pressures from 1-10 lb. per sq. in. Among applications are unloading hopper cars or ships and delivering to storage; handling materials ranging from 800 mesh to lumps up to 5 in. in size and up to 350 lb. per cu. ft. in weight; removing moisture from material and conveying to storage; and handling large quantities over long distances.

14 CONVEYORS — Pioneer Engineering Works has released a 52-page conveyor handbook, Form 612, covering two plans for ordering conveyors. Plan 1 covers pre-engineered conveyors and Plan 2 covers job-engineered types. Booklets show how to solve conveyor problems, how wide and how long conveyor should be, correct angle of incline, spacing of idlers, etc., together with technical formulas and figures.

15 COUPLINGS—Hose Accessories Co. Bulletin No. 7 describes and illustrates the Le-Hi line of fire and suction hose couplings and accessories. Included are the Gliderlug, pin lug, spann hole and shank type couplings, also valuable thread data.

16 CRUSHERS—McLanahan & Stone Corp. Bulletin RM-505 describes and illustrates single roll primary and secondary Rockmaster crushers. Construction details, dimensions, typical installations, and diagrammatic drawings are also given.

17 CYLINDERS—Loeden Mfg. Co. has issued a technical information bulletin CS-248, describing and illustrating the use of hydraulic actuating cylinders for removal of mold cores from fresh concrete pipe during production.

18 DIESELS—Cummins Engine Co., Inc. has published a 36-page catalog, Bulletin No. 5218C, describing and illustrating 68 high-speed diesels for automotive, industrial and marine applications, ranging from 50 to 550 hp., and three medium-speed diesels. Charts, cutaway drawings, specifications, data on torque, horsepower and fuel consumption, etc., are also given.

19 DRILLS—Acker Drill Co., Inc. has released Bulletin No. 30, describing and illustrating the Teredo portable core drill for drilling to depths of 500 or 600 ft. Specifications, construction features, and capacity tables are included.

20 DRILLS—Joy Mfg. Co. has announced a 4-page bulletin D-37 describing and illustrating the new Champion continuous blast-hole drill. Specifications are included.

Fill Out Reverse Side—MAIL TODAY

FIRST CLASS
PERMIT NO. 1417
Sec. 34.9, P.L.&R.
CHICAGO, ILL.

BUSINESS REPLY CARD
No Postage Stamp Necessary If Mailed in the United States

POSTAGE WILL BE PAID BY

ROCK PRODUCTS
309 WEST JACKSON BOULEVARD
CHICAGO 6, ILL.

FREE ! *Information on*

NEW LITERATURE

about your business

USE COUPON BELOW

21 DRIVES—Maurey Mfg. Co. has made available a 16-page bulletin, MVD-1000, giving complete information on multiple V-drives, including Ful-Grip sheaves and Mor-Grip multiple V-belts. Construction details and dimension tables are also shown.

22 DRYERS—Joy Mfg. Co. has issued bulletin F-28 describing and illustrating the A-8 rotary dryer with a capacity of 2 to 3 tons of sand per hr. at an average fuel consumption of 4.4 gal. of No. 3 Baume or diesel fuel oil with low or high pressure oil burners. It is also available with gas burners.

23 ELECTRODES — Stulz-Sickles Co. has released a bulletin describing and illustrating Manganal applicator bars and welding electrodes for repairing and rebuilding worn tractor parts. Manganal is said to have a tensile strength up to 150,000 p.s.i. and workhardens to 550 Brinell under impact and abrasion.

24 ELECTRODES—The Sight Feed Generator Co. has issued a bulletin on various types of Resarc hard-facing and manganese electrodes—Form RX-103, for application on equipment used in the cement and mining industries, for material handling equipment and on equipment used in excavating, dredging and quarrying operations. Typical application chart is also shown. Form RX-104 describes Rex-A-Lite and Rex-Tung hard-facing rods for oxy-acetylene and electric arc application.

25 FEEDERS—Traylor Engr. & Mfg. Co. has issued a 20-page bulletin, No. 1114, describing and illustrating its complete line of apron, grizzly, table and slurry feeders for use with crushers, rotary kilns and grinding mills. Cutaway views, construction features and typical applications are given.

26 GEAR REDUCERS — DeLaval Steam Turbine Co. Bulletin H-HS describes and illustrates various types of heavy-duty herringbone gear reducers for capacities up to 7000 hp. Specifications, horsepower rating tables, dimensions and weights, selection tables, and diagrams are also shown.

27 HOISTS—Ohio Electric Mfg. Co. announces an 8-page folder describing and illustrating the Bob-Cat heavy-duty electric cable hoist. Diagrams and line drawings, specifications, prices and directions for ordering are included in the bulletin.

28 HOSE COUPLINGS—The B. F. Goodrich Co. has published a 12-page catalog section, No. 3100, describing and illustrating various types of hose couplings and fittings. Specifications, general and maximum pressure recommendations and a description of threads are also given.

29 LUBRICATION—Stewart-Warner Corp. has published a pocket-size booklet on industrial lubrication entitled "Eleven Ways to Cut Production Costs," showing the Alemite barrel-to-bearing system of simplifying lubrication.

30 METAL TUBING—Chicago Metal Hose Corp. has released a 2-page bulletin describing abrasion-resistant flexible metal tubing for conveying slag, dust, ashes, cinders, and other granular materials.

31 MOTORS—A. O. Smith Corp. has published a 12-page bulletin, No. EM4-812, describing and illustrating 1- to 75-hp. polyphase horizontal motors. Construction details, and cross-section and cutaway views are also given.

32 MOTORS—General Electric Co. has issued an 8-page bulletin GEA-5332, illustrating typical installations of low-speed synchronous motors. Construction features, mechanical modifications and performance data are also given. Bulletin covers Type TS (3 phase) and Type QS (2 phase) motors in the "6000 series" with ratings from 20 to 15,000 hp.

33 OIL SEALS—Johns-Manville has issued a 16-page handbook of useful data on Clipper oil seals. Photographs show where to use seals and how to install them. Typical installations, construction details, and other information of importance to designers, engineers, and maintenance men are given.

34 PULVERIZERS—The Strong-Scott Mfg. Co. has published Bulletin No. 150, describing and illustrating unit pulverizers for direct-firing cement and lime kilns and rotary dryers. Cross-sectional view and diagrammatic drawings of cement plant installations are shown.

35 PUMPS—DeLaval Steam Turbine Co. has released a 4-page bulletin, No. 1125, describing and illustrating Type CP process pumps ranging in size from 1 to 4 in. and in capacities from 15 to 600 g.p.m. for heads of 15 to 240 ft. Cross-sectional diagrams, construction details, capacity and head range diagrams, and dimensions are also given.

36 PUMPS—Goulds Pumps, Inc. has published an 8-page bulletin, No. 725-3, describing and illustrating centrifugal pumps designed for handling corrosive liquids in the process and other industries. Construction details, cross-sectional diagram, specifications, performance charts, and dimensions are also given.

37 REFRACTORY CONCRETE — Universal Atlas Cement Co. has published a revised edition of the booklet "Lumnite Refractory Concrete," containing the latest available information on refractory and heat-resistant concrete. Detailed information on refractory concrete mixes and proportions of Lumnite and various aggregates, and tables for selecting proper types of refractory concrete for a wide range of temperatures and insulating conditions are also given.

38 RESEARCH—Allis-Chalmers Mfg. Co. 32-page bulletin, 07B6419A, describes and illustrates the company's basic industries' commercial research and testing facilities for research on development of new industrial processes or improvement of existing processes; research on mechanical development and application of process machinery; and fundamental research, or research into principles which underlie modern mechanical process or plant design.

39 ROD MILLS—Hardinge Co., Inc. has published Bulletin 25-B, describing and illustrating various models of the convex-head and the conical-ended rod mills for grinding and pulverizing. Typical installations, construction details, specifications, and performance data are included.

40 TRACTORS — Allis-Chalmers Mfg. Co. has released a 20-page pocket-size booklet featuring its complete line of industrial tractors. Specifications and a brief description of each power unit, wheel tractor and crawler tractor are given.

41 V-BELTS—Maurey Mfg. Co. has made available Bulletin FHP-101 describing Mor-Grip V-belts for fractional horsepower, giving comparative details, interchangeable data and price information on "3L" FO section, "4L" FA section and "5L" FB section sizes. Bulletin MV-201 describes Mor-Grip multiple V-belts and gives price list and comparison table for A, B, C, D and E section sizes.

42 WASHING PLANTS — Lippman Engineering Works has released Bulletin 1650, describing and illustrating the Washmore and Super-Capacity portable washing plants. Schematic flow diagrams, capacity and dimensional tables, specifications and comparison charts are included.

43 WIRE SCREENS—Newark Wire Cloth Co. has released a 64-page handbook, Catalog D, giving useful information on woven wire screens and a wide range of wire cloth products. Included in the manual is a glossary of terms; instructions on how to compute mesh, space, open area; illustrations of weaves; and a section on selecting, ordering and testing.

Detach and Send Us This Post Card

(8-50)

ROCK PRODUCTS, 309 W. Jackson Blvd., Chicago, Ill.

I would like to have the items circled.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43							

(Please print or typewrite name and address)

Name ..... (Position) .....

Company .....

Street .....

City & State .....

SLY

Pioneers and Leaders in DUST CONTROL

The **WHO'S WHO** of the **CEMENT INDUSTRY** *is the* **WHO'S WHO** of users of ***SLY DUST FILTERS***

• A trained Sly Engineer is near you to help lay out new additions or improvements. Write or phone.

Do you know of the New SLY DYNACLONE — self-cleaning, continuous operating, cloth-type Dust Filter?

For Rock Crushing — Raw Mills — Finish Mills — Pack Houses — Bulk Loading — Venting Silos.

THE W. W. SLY MANUFACTURING CO.

4766 TRAIN AVENUE • CLEVELAND 2, OHIO

Great Lakes Carbon Corp. Holds Open House at New Perlite Plant

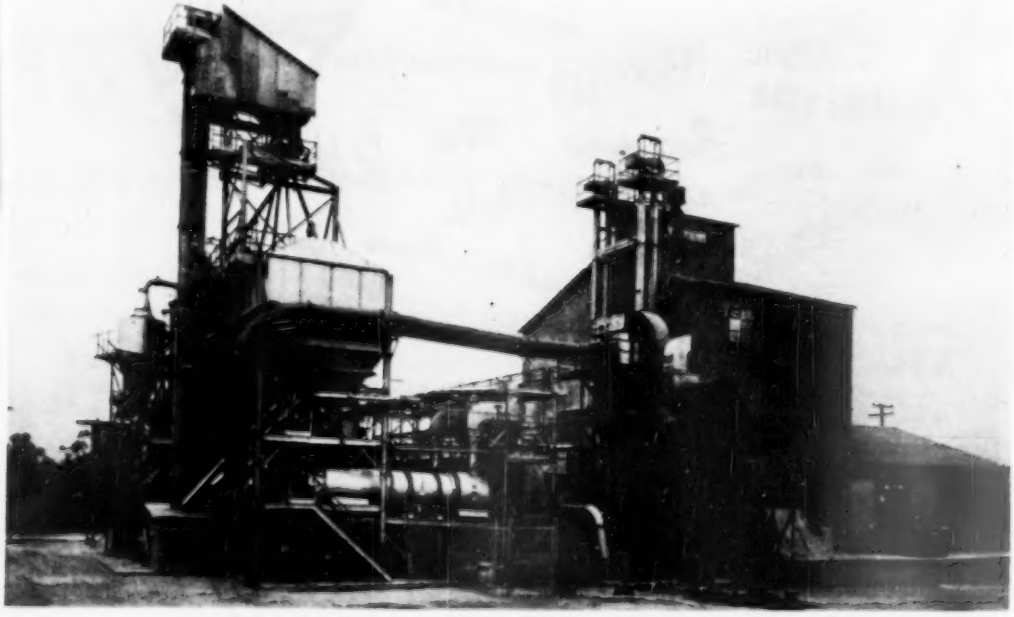
Operation has two rotary expansion kilns with total capacity of 150 tons per day; automatic features include central switchboard arrangement

View of plant showing railroad siding and crude storage silo

GREAT LAKES CARBON CORP., on June 9, 1950, held an open house at its new Permalite plant located on Madrona Ave., Torrance, Calif. Torrance is between Los Angeles and San Pedro. This occasion enabled contractors, architects, representatives of the press and others to see, for the first time, the company's new perlite expanding plant, and to see first hand some of the advantages that perlite has to offer to the construction industry. The program was well planned and staged. Robert Cornish, advertising manager, J. E. Mayhew, operating manager of the Torrance plant, and Fred Brose, plant superintendent, acted as hosts for the corporation.

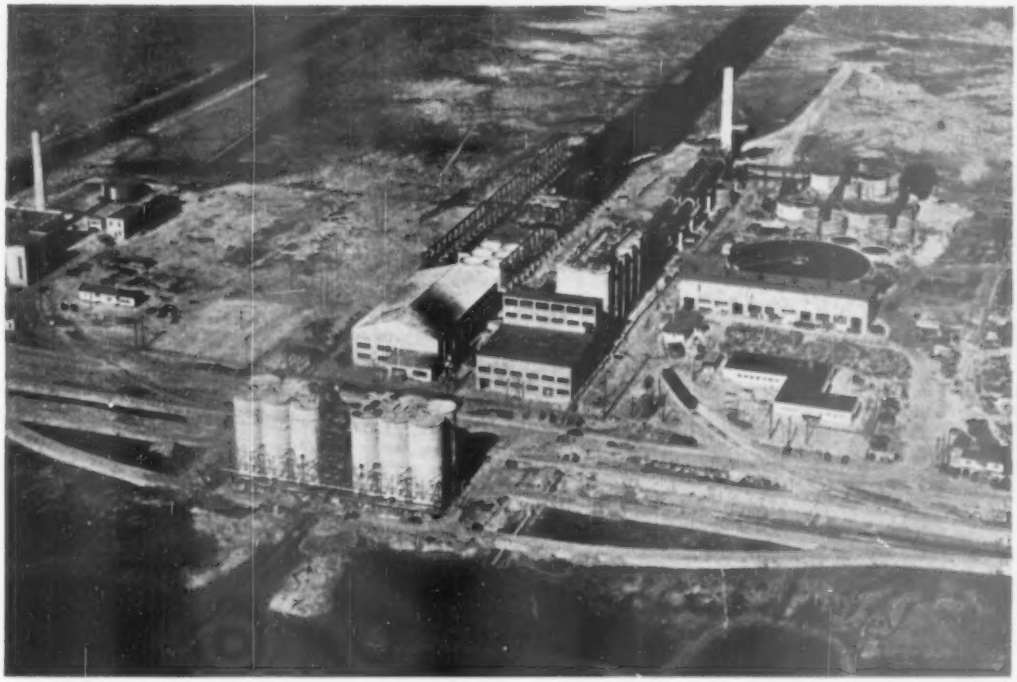
The perlite expansion plant at Torrance is one of the largest of its kind in the United States. The company recently placed a somewhat similar plant in operation at Linden, N. J., and the production of these two plants makes the Great Lakes Carbon Corp. the largest producer of expanded perlite in the country. The company secures its raw material from several deposits; however, the one at Socorro, N. M., is supplying most of the needs. Besides supplying its own materials, the company sells a considerable ton-

(Continued on page 194)



General view of Great Lakes Carbon Corp. Permalite plant at Torrance, Calif.

DEEP in the HEART of TEXAS!



At Corpus Christi, (because any Texas city is deep in a Texan's heart) the Halliburton Portland Cement Co's. new plant designed and built to produce 4,000 barrels of cement per day. Located on filled land to be adjacent to water transportation for raw materials and finished products, the foundation conditions presented unusual problems to support the heavy vibrating loads of mills, kilns and other machinery. Then, too, it was found more convenient and space saving on valuable land to store clinker and raw materials in concrete silos as well as the finished cement. All of these problems resolved themselves successfully and economically with our long experience in design and construction of complete plants, plant extensions or alterations and machinery erection. It will pay you to write us at any of our offices for estimates of costs, consultation in regard to layouts, kiln installations, machinery erection, foundations, etc. without obligation, of course.

Our business is making your business more profitable.

MACDONALD ENGINEERING CO.

Constructing Engineers

C.P.R. Building
Toronto, Canada.

188 West Randolph Street
Chicago

885 Bryant Street
San Francisco, Cal.

nage of prepared but crude perlite to other expanding plants.

The crude perlite is delivered to the Torrance plant in box cars. It is a relatively fine product usually in the minus 10- to 14-mesh range, although other sizes can be obtained. It is white to light gray in color with a somewhat glassy texture. After expansion, it is pure white, and because of its high insulation properties and extremely light weight, it is finding a large use in interior plastering. In this type of use the perlite replaces the sand ordinarily used. At the open house the company had several expert plasterers on the job who demonstrated the advantages the material offers by plastering sections of gypsum wallboard, metal, and wood lath.

The Torrance plant is a neat and well engineered piece of construction. It has two rotary expansion kilns, gas fired, that have a total capacity of 150 tons of expanded material per day. Plant changes and changes in technique based on experimental and research work are tending to increase this figure from day to day. The plant is of steel construction throughout and for the most part is uncovered.

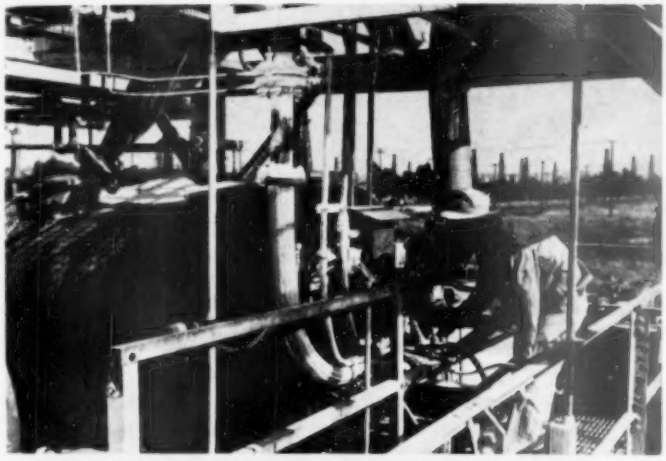
Many automatic features are included in the set-up, including controls from a centrally located switchboard. Facilities are available to rescreen the raw material secured from the New Mexico mine into three sizes. These are conveyed and elevated to steel bins over the expansion furnaces. The expanded material is cooled in pneumatic cooler-conveyors, with cyclone-type collectors recovering the coarser sizes and Rotoclones reclaiming the extremely fine sizes. The sludge from these latter collectors falls to rake dewaterers, from which the material is dumped to open trucks for final disposal.

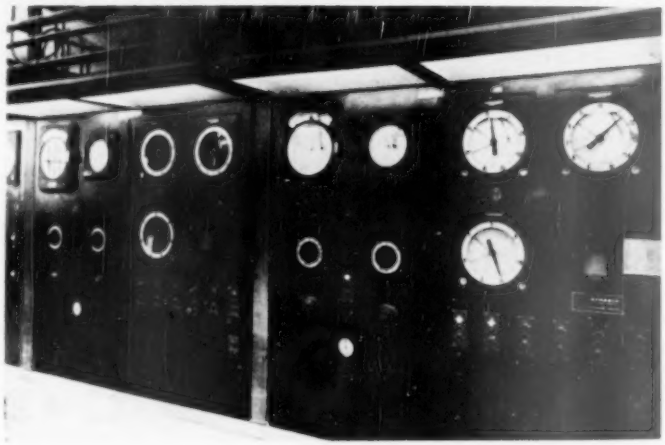
The finished product is packed in paper bags or barrels and marketed under the company's trade name of "Permalite."

Between 750 and 1000 people attended the formal opening of this new and modern plant. Refreshments were served. T. C. Carter is president of Great Lakes Carbon Corp.

Honors Employes

CALAVERAS CEMENT CO., San Francisco, Calif., honored ten employes recently for completion of 25 years of service to the firm. Company president William Wallace Mein presented gold watches and engraved silver fobs to each of the men and a leather traveling case to Miss Elaine V. Buckland, the only woman in the group. At the conclusion of the ceremonies, vice-president H. C. Maginn, chairman of the company's management committee, presented a watch and fob to Mr. Mein in recognition of his 25 years of leadership as company president since founding the firm in 1925.





Top: Testing laboratory, with mechanical plaster mixer at left. Center: Combustion chamber, No. 1 kiln. Bottom: Control panel board for kilns 1 and 2. Plant has two gas-fired rotary expansion kilns with a total capacity of 150 tons of expanded material per day

GREAT NEW ADVANTAGES IN TRUCK MIXERS

achieved with Chrysler Industrial Engines and Chrysler gyrol Fluid Drive

Reverse rotation of the drum without throwing damaging shocks and impacts into the transmission, engine and other parts of the machine!

No shear pins to replace! Smoother operation! Lower maintenance costs! Longer life! These are only a few of the advantages Chrysler Industrial Engines with gyrol Fluid Drive have brought to operation of truck mixers.

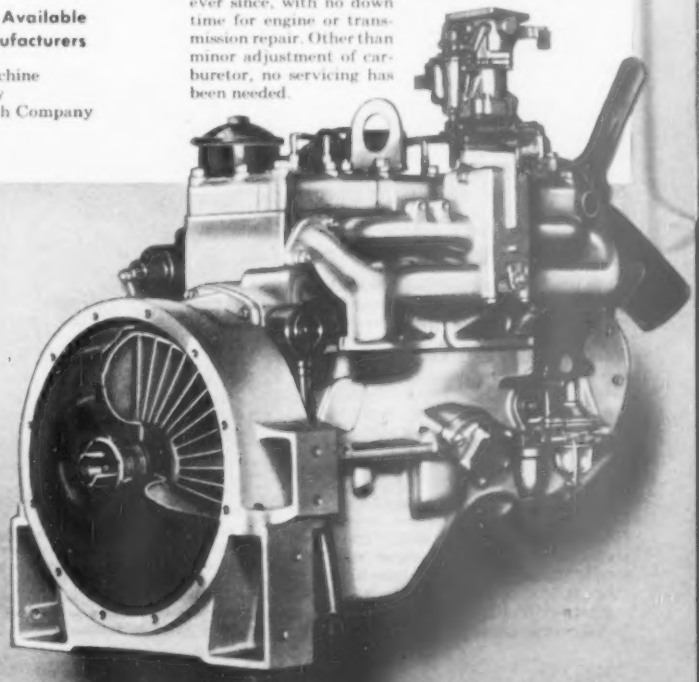
In addition, Chrysler Fluid Coupling prevents engine stalling, reduces clutch wear, eliminates jolts and gear rattle, simplifies starting from standstill with excessive load, gives gradual oil-smooth acceleration—opens a whole new field of improved operation for gasoline-powered equipment. See your Chrysler Industrial Engine Dealer or write us. ***Industrial Engine Division, Chrysler Corporation, Detroit 31, Michigan.***

Chrysler gyrol Fluid Drive Now Available For Truck Mixers From These Manufacturers

Blaw-Knox Division of Blaw-Knox Company
Chain Belt Company
Jaeger Machine Company
T. L. Smith Company

A Typical Experience

Five years ago, a Rex Moto-Mixer equipped with Chrysler Industrial Engine and gyrol Fluid Drive was placed in operation by the Tews Lime and Cement Company of Milwaukee. The unit has been operated continuously ever since, with no down time for engine or transmission repair. Other than minor adjustment of carburetor, no servicing has been needed.



Chrysler gyrol Fluid Drive is built integral with Chrysler Industrial Engines. Its cost is only a few dollars more than the conventional flywheel which it replaces.

CHRYSLER

Industrial Engines and Power Units

HORSEPOWER WITH A PEDIGREE

Executives Comment

(Continued from page 115)

Cement is barged from St. Louis to this modern storage and packing plant at Memphis, Tenn., where unloading and transfer is done by cement pumps

"As to the economical length of truck haul, there are so many factors involved that it is becoming increasingly more difficult to state it in terms of miles. In other words, it is not simply a question of break-even point between cost of rail haul and truck haul. There is involved the matter of demurrage, delivery time, proximity to railroad switch, size of the job, method of delivery on aggregate and steel, etc. Some customers prefer rail deliveries because they have a longer period for unloading into the warehouse. Trucks ordinarily must be unloaded so that they can return immediately, whereas the car can be unloaded at the dealer's pleasure. Such items of convenience often are of greater importance than a few cents in transportation cost. On the other hand, this element of convenience very often works the other way in favor of trucks so that a difference in cost of the truck haul over a rail haul will be overcome by the advantage of having a delivery go directly to the mixer on definite schedule as to time and quantity. Judging from the proportion of truck deliveries in our area it would seem that there must be a definite advantage to the customer in this type of service.

"It is our experience that where the greater part of shipments are made by truck from a plant the percentage of cement delivered into consignees' trucks tends to decrease rather than increase. This is caused by sheer inability to take care of small shipments on consignees' trucks without seriously interfering with the service from the plant. When the bulk of the movement was by railroad car and when plants were handling only one or two types of cement, the loading of an occasional customer's truck was no great interference; but in handling five or six different types of cement which means changing from one type to another in packer bins and in bulk loading bins it is a physical impossibility to take care of a substantial volume of business unless the trucks can be loaded to maximum capacity. This rules out the use of the pickup truck. It has been our experience that our customers are entirely sympathetic to this idea and regardless how the cement is bought, f.o.b. plant or on a delivered basis, the customer ordinarily leaves it to us to arrange for the heavy common carrier truck for the delivery."

A New York State manufacturer: "We do not operate our own truck equipment but employ a very reliable trucking firm that has served us for many years. In general, we find that we can make deliveries by truck as cheaply as by rail throughout a territory which we can serve, based upon f.o.b. plant price plus actual transportation to point of delivery.

"At present we are confining our deliveries to six counties, but are expecting to enlarge the area to possibly a 100-mile radius.

"We do not serve consignee's trucks at the mill. We believe that this would be very confusing and would not give sufficiently prompt service. Another reason that we do not serve customer's trucks is that in a contract arrangement with trucking companies you must give prompt loading of equipment in order to obtain the hauling rates that are essential. So, you can see the predicament we would be in if we were holding customer's trucks in our yard if we took care of the contract hauling."

A Texas manufacturer: "Until about 60 days ago there has been no bulk truck-delivered cement from manufacturing point to destination. At the time deliveries by bulk truck started from San Antonio to a large dam project near Marble Falls, Texas, a distance of about 90 miles.

Shown here is the trolley takeoff on a cement kiln for the purpose of recording temperatures as measured within the kiln by thermocouple. The practice has been adopted, in several long wet process kiln installations, as a measure of consistency in order to minimize mud rings and load fluctuations

"We do not ship cement by truck either in bulk or in packages from the mill. We do not contemplate truck deliveries in the foreseeable future.

"The load limits imposed on Texas highways make truck deliveries impracticable and uneconomical. For distances over 30 miles truck rates are considerably higher than carload rail rates. Truck rates for switch movement cannot compete with railroad rates for inter-city movement.

"It would be more expensive for us to load trucks at our docks than the loading of box cars. Smaller loads for trucks than for box cars would increase our handling in the accounting department, consequently increase cost.

"So far as we know, no cement is shipped from any mill to consignee by truck in Texas. The only exception is the bulk delivery from San Antonio to Marble Falls. We understand from the trucking contractor that in this instance his trucks are loaded at bulk plant of the general contractor set up on property owned by the cement company. They are not loaded by the cement manufacturer."

California manufacturers: "Over 90 percent of the shipments from our plant have been made by truck during the past year and a half. The entire cement industry in our area moves an estimated 75 percent of total shipments by truck, with the remaining 25 percent traveling by rail and boat. We have a large company-owned truck fleet, and in addition, we use contract truckers for approximately an equal number of hauls.

"The economical length of haul is about 350 miles, and is limited mainly by licensing fees for crossing the boundaries of our state. The users of our cement prefer the quicker and more convenient truck deliveries. In fact, the placing of a growing number of ready-mix plants and contract jobs at off-rail locations in recent years, has largely dictated our shift from rail to truck deliveries."

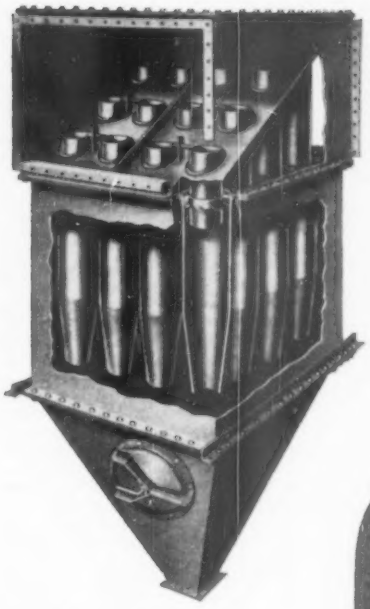
* * *

"Total shipments made by truck from our plant are approximately 85 percent. While we do not intend to speak for the industry in this area, it is my opinion that the figure of 85 percent would be about standard for the industry in northern California.

"Too many factors influence the economical length of a truck haul to be able to comment specifically. Some of these factors are service, volume, location of competitive mills, competitive transportation rates, special type of equipment, availability of backhauls, cost of unloading and many others.

"Customers almost invariably desire truck service over any other type. We do operate our own fleet of trucks in conjunction with our contract carrier. There is a definite increase in percentage of deliveries to consignees' own truck equipment."

(Continued on page 198)



In dust and fly ash recovery

MULTICLONE COLLECTORS

***and only Multiclones* give vital advantages like these...**

No wonder "MULTICLONE" is the leading name in the centrifugal recovery of dust and fly ash from all types of gases, hot or cold.

No other mechanical recovery equipment has so many years of dust and fly ash recovery experience behind it . . . or has such uniformly high collecting efficiency . . . or provides so many other money-saving, space-saving advantages as MULTICLONE. The four advantages outlined below are by no means the complete MULTICLONE story, but are typical of the vital savings found *exclusively* in MULTICLONE equipment . . .

Uniformly High Recovery:

MULTICLONE's multiple *small diameter* tubes—made possible by its exclusive vane design—whirl the dirty gases with greater centrifugal force, thus throwing out not only the large, medium and small particles, but also a high percentage of the *extremely small* particles of 10 microns and less. This, coupled with the fact that there are no pads or filters to become choked with recovered material, results in a more complete recovery of *all* suspended materials from the gas stream.

Long and narrow

Square

Maximum Adaptability:

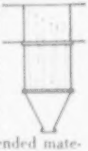
In addition to its unusual compactness, the MULTICLONE is also unusually adaptable to various installation requirements. Where head room is low it can be installed with side-inlet side-outlet connections. Where side clearances are restricted, it can be installed with side-inlet top-outlet connections. In addition, without changing capacities, the shape of the unit can be varied—long and narrow, short and wide, or square—to fit restricted spaces . . . and its single-inlet single-outlet duct requirements permit greater flexibility and simpler installation. These savings slice installation costs, space requirements and insulating expense.

Space-Saving Compactness:

Plant space costs money—so be sure to check space requirements carefully. As shown in the accompanying chart, the MULTICLONE requires less floor space and less cubic space than any other unit of comparable capacity and performance. Translate these savings into today's high costs for plant space and you readily see the great importance of this one MULTICLONE advantage alone!

Make	Relative Space Requirements In Sq. Ft.	In Cu. Ft.
Multiclone	1.0	1.0
Collector A	2.1	1.8
Collector B	5.9	3.2
Collector C	6.8	3.9

Minimum Maintenance:



The MULTICLONE has no high speed moving parts to repair or replace . . . no pads or filters to clean or renew . . . nothing to choke the gas flow or increase draft losses as suspended materials are recovered. MULTICLONE draft losses remain uniformly low *at all times*. Further, the recovered material from an entire bank of tubes is collected in a *single* hopper—far easier to service and maintain than the multiple hoppers of conventional cyclone units.

FREE INFORMATIVE BOOKLET

This 32 page booklet outlines the basic principles of centrifugal dust recovery and shows the many ways MULTICLONE advantages assure higher recovery at lower overall costs. A free copy of this booklet will gladly be sent on request. Write today!

Before you decide on any recovery equipment be sure to get complete information on MULTICLONE advantages. A letter, wire or phone call to our nearest office places this information in your hands without obligation. Get all the facts and you will get MULTICLONE Collectors!

WESTERN Precipitation CORPORATION

ENGINEERS, DESIGNERS & MANUFACTURERS OF EQUIPMENT FOR COLLECTION OF SUSPENDED MATERIALS FROM GASES & LIQUIDS

Main Offices: 1006 WEST NINTH STREET, LOS ANGELES 13, CALIFORNIA
CHRYSLER BLDG., NEW YORK 17 • 1 LaSALLE ST. BLDG., 1 N. LaSALLE ST., CHICAGO 2 • HOBART BUILDING, SAN FRANCISCO 4, CALIFORNIA
PRECIPITATION CO. OF CANADA, LTD., DOMINION SQ. BLDG., MONTREAL

"It is my opinion that approximately two-thirds of the cement delivered from five southern California plants moves by truck from the plant to destination. In northern California I would estimate the movement by truck from the mill at 85 percent to 90 percent of the total.

"The maximum haul with truck equipment from the southern California mills is in the neighborhood of 120 miles. In northern California the truck maximum would probably be closer to 200 miles.

"Generally speaking, the customers greatly prefer truck delivery from the mill. In the case of sacked goods, the packages arrive in much better condition than when shipped by rail. The interval between placing the order and the receipt of shipment is a matter of hours for truck delivery; days for rail delivery. A recent study of ready-mixed concrete plants in the Los Angeles metropolitan area and San Diego metropolitan area showed the following interesting results:

Ready-mix plants located exclusively on rail	1
Ready-mix plants equipped for truck or rail delivery	17
Ready-mix plants with truck delivery only	134
Total	152

"Where the railroads have established a lower rate on 100,000 lb. loading (or heavier) cement is shipped by rail from the mill to transfer plants owned and operated by the cement companies and hauled locally to the off-rail bulk user. We own and operate a fleet of approximately 28 highway trucks, hire a considerable number, and also load consignee trucks which come to the mill.

"I do not for a minute believe that conditions which make trucking so favorable in California prevail in many other sections of the country."

Highway Engineers' Comments

Officials of the various state highway departments, in reply to questions as to the use of bulk cement truck haul, indicated that more cement is being delivered by truck in areas where such transportation has been the accepted practice. A trend in that direction is indicated in several states. That was to be expected and nothing conclusive can be drawn from a summary of replies. In nearly all cases the contractor purchases the cement for state projects, except in cases where the state does some of its own maintenance work, and it is the contractor's responsibility to handle cement as he sees fit.

Among the more interesting replies are the following:

A midwestern state: "It has been our observation that in the last year or two, there has been a trend in the direction of truck shipments directly to the job site and to ready-mixed concrete plants in the southern half of the state. We assume, because of the continuing trend, that savings are effected either in the shipping costs, the handling costs, or both."

An eastern state: "Currently with 24 plants furnishing cement for this department's use, 18 of these plants are located in the southern or eastern part of the state, and none of these are delivering cement by truck. The best advice that we have regarding these 18 plants, is that they do not contemplate deliveries by truck. All of the six plants furnishing cement to the western part of the state are now delivering by truck. Two of these plants are now in their third year of trucking, three are in their second year, and the sixth plant has just begun this year. One plant operating its third year advised that 75 percent of its deliveries in 1949 was made by truck and anticipates that 90 percent would be delivered by truck in 1950. The sixth plant referred to, which has just begun truck shipping, advised that it expected to deliver to the Department of Highways during the pavement construction season eight to ten thousand barrels daily by truck. The other four plants have increased their truck hauling on highway projects.

"We are not in a position to fully judge the economy and practicability of truck hauling. We can cite other instances of economy where a contractor who had his cement delivered by rail would have paid 54 cents per barrel freight from the cement plant to a rail siding near his project, and 18

Continued on page 200

KEEP YOUR HANDS

Out of cement handling!

Handling bag cement is hard on the back and tough on the pocket-book. These 3 Erie Cement Plants take bulk cement mechanically from cement cars via undertrack screw and bucket elevator to the storage bin. Whatever your cement requirements there is Erie Cement equipment to meet your needs.

The Type "M" series at the left in 4 standard capacities will store from 172 to 600 bbls. in a portable-type plant.

The Type "L" series at the right in 3 capacities 575 to 1025 bbls. offers a knock-down or semi-portable plant for the large cement user.

The CSB-Series the "silo type" offers two diameters (11 and 12 ft.) and 5 standard capacities in each to provide storage for 274 to 1014 barrels of cement.

Give Erie engineers the description of your cement needs and their recommendations will speed your cement batching, save enough over bag handling to pay for the plant and eliminate cement waste.

Erie Type "M" portable single compartment cement plant in 4 capacities (172 to 194 Bbls.) (270 to 304 Bbls.) (437 to 492 Bbls.) (525 to 600 Bbls.). Write for Booklet M-3.

Erie CSB 592 Bbls. (11 ft. dia.) "Silo" Cement Bin shown. Available in 11 and 12 ft. diameters in 5 sizes each—also widely used for added recirculation ground storage in any capacity desired. Write for data.

Erie Type "L" Single and Double Compartment Cement Bins standardized in 3 Capacities (575 to 645 Bbls.) (685 to 770 Bbls.) (910 to 1025 Bbls.). Write for Booklet L2

ERIE

STEEL CONSTRUCTION COMPANY

708 GEIST ROAD • ERIE, PENNSYLVANIA

cents per barrel more to haul the cement from his batch plant located at the rail siding to the paving project. By hauling the cement directly from the cement plant to the batch plant located immediately adjacent to the project, his cost was 28 cents per barrel. It would appear that the practice is practical. However, economically, there are some obstacles which will have to be corrected by collaboration of the contractors with the cement companies. For example: generally the contractor will have a storage silo of possibly not over 250 bbl. When using bulk cement directly from bulk cement cars he had the advantage of using the cars for storage, particularly so when paving operations were delayed by rain or other adverse weather, in which case he paid demurrage on the cars to withhold their use for storage. However, when the contractors order three or four truck loads of cement (which in this state are limited to 70 bbl. per truck load) and when they arrive at the job and are unable to unload their cement into the contractor's silo, the cement company is then seriously handicapped in furnishing service. More particularly so when rain begins after the trucks have arrived to discharge their loads into the silo. It is our opinion that truck hauling does justify special service facilities at the project."

A central state: "More cement is being delivered to highway projects by truck. The trend in this direction is very marked. The practice is proving economical and practical due to the lesser cost and the greater flexibility in adjustments of job production. Contractors do consider that the use of trucks for hauling cement direct to the project is justified, even though some special service facilities may be needed."

A southeastern state: "Cement for highway projects is being delivered by railroad instead of by trucks except for projects in locations within an economical truck haul distance of portland cement plants located within the state.

"The practice of delivering cement by truck as indicated above only is proving practical and economical when compared to the use of rail haulage and transfer to trucks on the job.

"For the small amount of cement required for the majority of highway projects in this state the elimination of double handling would not justify special facilities at the project. Such facilities, however, would be justified on an occasional project of considerable magnitude."

A midwestern state: "There are several factors to be taken into consideration in determining whether it is economical to have the cement delivered by truck. One of these items is the location and cost of a siding installation. If the cost of the siding is high, or if no existing siding is available and if the best location available for siding necessitates a long

batch haul, the delivery by truck is more economical. We, in this department, have had very little delivery by truck so far, but in the instances where such delivery has been made, the trucks have hauled about 65 bbl. per load. There are trucks in the northern part of the state making deliveries on other work that take as high as 125 bbl. per load. Most of the storage facilities on the job for bulk cement will accommodate about 400 bbl. We have not had any occasion where it has been necessary to transfer the cement from the railroad car and haul it by truck to the batching plant. In all of our cases, the batching plant has been located at the point of rail delivery when the cement was delivered by rail. I have stated above that we have not encountered any double handling of the cement and the facilities required to handle bulk cement are in some cases less cost than by rail."

Capacity vs. Demand

It is the general impression of the cement industry that productive capacity, now that operations have been rehabilitated and enlarged, is sufficient to meet normal high demands. The rate of cement construction activity is considered abnormal and not likely to continue at the present unparalleled space. However, it is recognized by some manufacturers that additional capacity might be justified in certain areas of the nation. Manufacturers, in reflecting on past experience, do not believe it wise to build productive capacity up to meet temporary periods of peak demands, not only because of the certain leveling off periods that follow peaks, but they cannot reconcile the high cost of plant investment at today's prices with the returns to be obtained. Typical comments follow:

"Even though productive capacities have been increased at nearly every cement plant, industry has not been able to make on-the-spot shipments for every barrel its customers have wanted; additional mills right now would correct this. I personally feel that this above-normal peak or demand will continue. I am hereby differentiating between the 'sky is the limit' demand and the 'normal but higher than ten years ago' demand we will have for five to eight years to come. In other words, I do believe the present capacity will take care of and have a cushion of 15 percent or 20 percent of productive capacity for the true future requirements. To go a lot further with the picture, my company, enjoying its fair share of the business, shipped only an average of 46 percent of its rated capacity during the 20 years prior to 1946. At present, we cannot meet the demand. I believe when this surge is over, and that within two years, our market will level out to within 75 percent or 80 percent of our present production."—Kansas.

* * *

"There are some localities where ad-

ditional production apparently could be utilized, but generally speaking, the present over-all productive capacity of the cement industry is reasonably sufficient to take care of the foreseeable demand in any normal year."—New York.

* * *

"The cement industry as it exists today is undertaking considerable expansion in the various plants across the country. It is my opinion that the industry, today, is the only agency whereby the steady increasing demand for cement can be met. Because of the difficulty of raising this capital for new mills, I think the only source of new capital for new mills will be through the monies saved out of earnings."—Michigan.

* * *

"If the problem is as you state 'the steadily increasing demand for cement,' obviously productive capacity will have to be increased. It has been the thought on the part of many in the industry who are probably wiser than I, that the demand may not 'steadily' increase and that somewhere along the line a slacking off of demand would develop. In the case of our own company, you are familiar with our expansion program under which we have increased the productive capacity of our own plants at least 250 percent. [These are completely new plants or additions to existing plants—this figure does not include the acquisition of already existing plants by this company.] Certainly in the views of many, we have possibly over-extended our own company."—A western producer.

* * *

"I will answer your question by saying that the cement industry as it exists today will probably be able to supply all the demand for cement with very little additional capacity. Our northeastern plants were down for six weeks this spring for lack of storage space for cement; or, to put it another way, for lack of business in the northeastern area in the early spring."—New York.

* * *

"It is our candid opinion that the demand for cement at the present time is entirely abnormal. We believe that in normal times the existing cement manufacturing companies could handle the business in a very satisfactory way."—Pennsylvania.

* * *

"The demand for cement today in some sections is abnormally heavy, due to stimuli inherent in present synthetic prosperity. The increase in the productive capacity of mills the past two years has been very substantial, and, by and large, even today the industry is meeting the demand. With the return of normalcy, which will bring buyers' instead of sellers' market conditions, I believe there will be a super-abundance of cement to meet the demand, without building new additional mills."—Missouri.

* * *

"I believe it is rather obvious there

will have to be more production in the cement industry, this applies particularly to certain areas."—Washington.

* * *

"It is believed that with normal volume in this area that the existing cement plants will be able to meet the demand."—New York.

* * *

"In answer to your question, I am convinced that in our particular territory, namely the Lehigh Valley District, the present cement plants will be able to take care of the demand at least for some time into the future."—New York.

* * *

"We think it can be said that there probably would have been more additional cement plants built during the past two years if it were possible to bring about a proper relationship between the required investment at current construction costs and the earning potential of the new capacity at the present level of competitive prices. All studies we have made up to this time indicate that a new, independent venture could not be justified today."—Illinois.

* * *

"As to whether or not additional cement mills are needed to take care of the cement demand, we would have to be able to interpret the unusual present demand, whether it is a flash demand for sudden peak building, or whether there is a likelihood for sustained high level of construction requiring concrete. It seems to us that this is a question that each producer in each area must determine for itself. It is conceivable that as far as the over-all economy is concerned it might be better to experience occasional periods of shortage which have the effect of leveling off the construction rate rather than to go hog wild in trying to build up the mills to a manufacturing level that would satisfy all peak demands."—Michigan.

* * *

"In our opinion the present manufacturing capacity of the cement industry is sufficient to take care of present and probable future demands, provided that some method can be found to eliminate high peak demands. There may at times be shortages in certain districts, but as a general rule such shortages can be taken care of by shipments from other districts. It would, of course, be helpful if large consumers provided some storage capacity of their own, but I suppose that is just too much to expect after all of these years of overnight deliveries."—Pennsylvania.

* * *

"I believe that production of cement in our area is sufficient to meet needs when they return to normal. Of course, we cannot say with certainty what normal is. Our company is modernizing by the installation of a long kiln, which we are doing more for the economies to be experienced than an increase in our production, although it

will, of course, lend itself to that also." —New York.

* * *

"There may be areas which, due to population growth and increasing transportation costs, are not now being served in adequate supply or at a reasonable price. If such exist I do not know of them.

"As a general proposition, however, I believe that the interest of the construction industry will best be served through the improvement, and, where justified, the enlargement of existing plants. Only in this way can the cost of new capacity show a reasonable return, at presently prevailing cement prices. This is another way of saying that an investment of $6 per barrel is unattractive at a gross return which is of the order of $2.25 per annum." —Pennsylvania.

* * *

"Additional mills are being built, and many existing mills are being enlarged. With the projected increase in production there should be plenty of portland cement to satisfy the demands of the construction industry over the next few years, excepting abnormal seasonal demands in certain locations."—Southeast.

* * *

"We think the present abnormally heavy demand is undoubtedly somewhat attributable to postponed construction during the war years."—Michigan.

* * *

"It would seem to us that the industry has no assurance that the demand will steadily increase. In the 40 years that this plant has been operating there has been only a small percentage of the time when the industry was not able to supply the demand. In fact, during most of that period the industry was over-produced. Should the demand continue heavy, it would seem to us that it could be met by the present plants increasing their production, rather than the establishing of new plants, especially in view of the high construction costs that exist toda."—Iowa.

* * *

"Present rate of consumption in the state of Texas is about 18,000,000 bbl. for 1950. There are now eleven cement plants located in Texas with total rated capacity of about 16,700,000 bbl. If the growth of Texas continues at a rate equal to the past ten years, it is apparent that additional facilities in some areas will be required to supply the demand. The most serious shortage area at this time is in west Texas due to extremely active oil well drilling."—Texas.

* * *

"Despite the tremendous demand for cement, we believe that existing mills in this area will continue to be able to supply the trade, without the addition of new plants. Supply and demand have been well balanced in this part of the country, even in the post-war boom market of the past years. Any shortages have been sea-

sonal and of brief duration; they have invariably been corrected within a few months. Furthermore, recent years have witnessed a considerable increase in this region through expansion of existing plants."—California.

* * *

"My response must be restricted to conditions in southern California which has an annual productive capacity from five mills of approximately 16,500,000 bbl. annually. Shipments in 1949 from these five mills totaled somewhere between 12,000,000 and 12,500,000 bbl. They may be perhaps 10 percent higher in 1950, but there will be no shortage of cement in southern California. In fact, an order received this afternoon will be delivered by truck at consignee's place of business not later than 8:00 tomorrow morning."—California.

* * *

"I believe that the individual mills at their present locations will be able to supply the increasing demand for cement on the Pacific Coast providing such mills modernize and increase their efficiency to a certain degree plus some plant expansion program."—California.

* * *

As this is written, the latest information is that no let-up in the cement construction boom is anticipated for the balance of 1950. The Commerce Department and the Labor Department's Bureau of Labor Statistics have predicted that spending for new construction for 1950 will be a record total of nearly $26 billion. This figure was estimated without consideration of any possible upset in building due to the Korean fighting. The estimate is 14 percent above the 1949 total.

Freight Absorption

Since President Truman's veto of the pricing bill, some manufacturers believe that the confusion as to policies permissible to follow in establishing prices remains the same. Others have taken his comments, in vetoing the bill, to mean that the validity of freight absorption will be upheld, if done in good faith. A good number of companies are planning to continue to absorb freight in cases where they have done so and it is considered necessary to meet competition. The majority has been pricing cement at the mill plus freight to destination at least for the last year. Some of these companies will start to absorb freight when it is deemed necessary to protect company interests.

Marquette Cement Manufacturing Co., which has stuck to its policy since the Supreme Court decision, to continue to quote competitive delivered prices, recently published the following statement on pricing practices under the heading "Where Do We Go From Here on Pricing Practices:"

"On June 16, 1950, President Truman vetoed Senate Bill S.1008—the 'Delivered Pricing Bill.' This bill was intended to redeclare the lawfulness of independent, competitive de-

livered pricing. Actually the lawfulness of such pricing was never in doubt except as it was condemned in pronouncements of the Federal Trade Commission and in the uncalled for conversational part of the Supreme Court opinion in the Cement Case.

"It was this condemnation that caused a large segment of the heavy goods industries to adopt f.o.b. plant pricing. Fortunately for sellers, but unfortunately for buyers and the general public, this action was taken in a period when demand far exceeded supply.

"Many have said that the Supreme Court opinion in the Cement Case outlawed the 'basing-point system.' The truth is that a 'basing-point system' with agreed upon 'basing-points' and agreed upon 'base prices' was always an unlawful practice in direct conflict with the Sherman Antitrust Act. However, we were never interested in this moot question since the Trade Commission found there were no such agreements in the Cement Industry. Furthermore, such a system was never used by us, nor was it in any way similar to the competitive delivered pricing customs of the industry.

"In his veto message on the Bill S.1008 the President said:

'I recognize that businessmen have been concerned lest they be penalized for perfectly sensible and appropriate competitive action.'

"But he added,

'I believe their concern is unwarranted.'

"Then he proceeded to deduce from a certain Court decision and from recent clarifying statements by the Trade Commission that *independent, competitive delivered pricing is lawful.*

"These words of the President and the current statements of the Trade Commission are right down our alley. We did not adopt an f.o.b. plant price method of selling following the 1948 Supreme Court decision of the Cement Case. We did not interpret the conversational part of the Court's opinion as a legal prohibition of all delivered pricing. And since that time we have steadfastly adhered to our original promise to our customers, made in May, 1948, and have continued to give them the benefit of competition at their point of use.

"Purchases of cement and of all heavy goods, when sold on a true competitive basis, have always been firmly based on the lowest total cost at the customer's point of use. A long standing policy of ours and of the law is that no customer shall be the victim of discrimination. By lowering our price to meet a lower price of a competitor in a particular market, our customer in that market is assured that he has no cost disadvantage to overcome in his competitive efforts. Thus, our policies tend to benefit the ultimate consumer.

"*In the light of the recent developments, we now reassure our customers*

that we intend to make no change in our long-standing pricing and selling policies.

"It seems to us that there is even less justification today, Mr. Truman's statements considered, for charging a higher price for cement than the lowest competitive price in any market in which we seek to do business. Statistics on file with a Senate Committee show that f.o.b. plant pricing, induced by the previous pronouncements of the Federal Trade Commission and by the conversational part of the Supreme Court opinion of the Cement Case, has cost the public many millions of dollars in the last few years. *This need not go on.*"

Other comments on the subject were, typically, as follows:

"Our company has never made prices to its customers on the basis of so-called freight absorption. Transportation has always been an element of cost in determination of price to be quoted to the customer at point of delivery. 'Freight Absorption,' as I understand it, is a term coined years ago in industry when there was a so-called Pittsburgh Plus system of pricing in the steel industry. Never having had any so-called 'base,' our company under such circumstances has never been involved in the so-called 'freight absorption' practice."

Other comments follow:

"In our opinion President Truman's veto message confounded the already existing confusion with regard to basing point practices. What we may ultimately do under these circumstances we do not know. No conclusions have been reached as yet, and since the Supreme Court upheld the Federal Trade Commission's Cease and Desist Order, all of our sales have been made f.o.b. mill."

* * *

"Your question as to whether we will absorb freight or quote f.o.b. mill prices is one we can't answer at the moment because we are about as confused as Mr. Truman and Congress on this subject."

* * *

"We have not as yet started to absorb freight, but it is my opinion that we will in the not too distant future. Many companies are doing so at the present time.

"While the President did veto Senate bill S.1008—The Freight Absorption bill—which passed both houses of Congress, I believe what the President said in his veto message, and what has since been said by members of Congress, should clarify much of the confusion as to the validity of delivered pricing and the legality of freight absorption, where found necessary to meet bona fide competition at market destinations."

* * *

"We meet competition where we have proved to ourselves that it exists."

* * *

"In answer to your question when the Supreme Court rendered its de-

cision against the so-called basing point method of quoting, we have up to the present time quoted f.o.b. cars our mill or destination prices based on our current mill price, plus the full freight from our mill to destination. From here on our policy will be determined with the view of protecting the interests of this company."

* * *

"Our company does not absorb freight. We ship on an f.o.b. mill base price plus actual freight."

* * *

"I would say that our company does not absorb any freight on cement shipments and we do not contemplate any change at this time."

* * *

"The demand for our product for the past two years has been sufficiently localized that we have not been confronted with the problem of going very far afield for business. This means that we have not had the problem of freight absorption. We quote f.o.b. mill price and delivered price, as the customer may elect. We cannot see any immediate prospect of having to resort to general freight absorption in order to be competitive. When and if that time arrives, we shall probably meet competition where and as we find it."

* * *

"We, like most other people, are somewhat confused as to the legality of freight absorption. Our company at present does not absorb freight to meet competitive prices at destination. We quote a mill price f.o.b. cars at any of our mills to persons desiring to purchase cement in carload lots at f.o.b. mill prices."

* * *

"As to the effect of the President's veto of the Basing Point Bill, we believe that we have the right to meet competition by the absorption of freight in individual cases. The hazard, of course, is that a resulting equal price lays one open to the suspicion of collusion, and I feel that suspicions have been given the weight of fact and for that reason absorbing freight is hazardous. However, I believe that when the industry catches up to demand that freight will have to be absorbed or prices materially increased if the area is limited to that that can be served on an f.o.b. mill price basis."

* * *

"We quote f.o.b. mill price, but where it is necessary to absorb freight in order to meet bona fide competition we make what absorption is necessary. Each variation from f.o.b. mill price is handled on a case by case basis, and a clear record made establishing the necessity for varying from the f.o.b. mill price."

* * *

"Your appraisal of the situation which confronts a manufacturer as a result of President Truman's veto of the O'Mahoney Bill is accurate, in that we know no more regarding the

legality of our marketing practices than we did before he acted on the bill.

"In our statement of compliance to the Federal Trade Commission, we reserved the right to meet our competitors' prices whenever and wherever it appeared in the best interests of the company to do so. The President's veto of this bill has not changed our position on this matter."

* * *

"Both President Truman and the Federal Trade Commission have said, in effect, that there is nothing contained in the present laws which prevents a single company from meeting competitive prices. This has not yet been confirmed by the courts. Our company quotes f.o.b. mill prices. There are a few instances where we have absorbed some freight to meet competitive conditions."

* * *

"We sell f.o.b. plant and have no plans for modifying or changing that practice in the immediate future, unless present confusion over freight absorption is cleared up."

* * *

"This company does not at the present time absorb freight. Should our marketing conditions change, causing us to look for additional markets, we believe it would be our policy to absorb freight sporadically as we saw fit to meet market conditions in such markets as we chose to compete in, but not adopting a flat basing point system of pricing."

* * *

"Our attorneys are attempting to interpret the recent statements by the Federal Trade Commission and President Truman, and seem to be in a state of some confusion."

* * *

"We have found that the practice on the West Coast of absorbing freight is apparent, however, it is our understanding that most, if not all the mills, quote f.o.b. mill plus freight. It is the policy of our company to allow the buyer an option of a destination price or a mill plus freight, whichever he so desires."

Blended Cement

(Continued from page 178)

asbestos cement industry when using heterogeneous cement was the much easier handling of the fresh raw sheets due to their improved plasticity. Loading tests on corrugated asbestos cement sheets yielded 15 percent higher strength than with rapid hardening portland cement under identical mix and operational conditions. The greatest difference, however, was apparent in permeability tests under increased pressure: 70 percent higher pressure was needed for heterogeneous asbestos sheets to achieve the same degree of penetration as shown by rapid hardening portland asbestos sheets.

Waste Heat Power

(Continued from page 130)

feed to kiln speed. A 100-hp. G.E. motor turns the kiln at 85-90 r.p.h. through a Texrope and Jones herringbone gear reducer. The synchro-tie is through a 12.5 kv.a. generator which supplies current for the motor driving a Fuller rotary feeder on the kiln feed bin. This bin is filled by a 10-in. F-K pump. For emergency, an Allis-Chalmers W-25 tractor power unit is available to turn the kiln in event of power failure.

The clinker cooler is a 4-ft. 6-in. by 70-ft. Allis-Chalmers horizontal air-quenching grate cooler, with 18-ft. conveying end pan extension, which discharges cooled clinker into a clinker pit in the undercover storage area. It is planned to install a clinker crusher on the cooler itself. It has an automatic bed speed controller which is regulated to maintain a constant predetermined undergrate pressure by speeding up or slowing the speed of grate travel. For variable speed operation, the drive is a 15-hp. d-c motor through Texrope. Undergrate pressure is the means of control of the temperature and flow of secondary air, which is preheated to about 1400 deg. F. when forced through the hot part of the clinker bed. Air forced through the bed at the cooler end of the grate, after further cooling of the clinker, is exhausted to waste, the division being a baffle within the cooler housing. Grate pressure is held at 2½ in. w.g. to hold the secondary air temperature and flow at the desired figures which is maintained with a 3- to 4-in. bed of clinker. The forced air fan is rated at 57,000 c.f.m., at 100 deg. F., 4 in. w.g., is driven by a 50-hp. motor through Texrope and has a variable damper louvre which is set manually.

Waste Heat

Kiln exit gases are drawn successively through a B & W Sterling-type waste heat boiler rated at 26,000 lb. of steam per hr. at 450 p.s.i. (750 deg. F.), an economizer and 9 VG. Multiclone double-hopper dust collector to exhaust through the stack. The induced-draft fan is a Green Fuel Economizer Co. No. 75 double-inlet unit rated at 64,160 c.f.m. at 450 deg. F. when turning at 700 r.p.m. Actual temperature of the gases is about 425 deg F. upon exit from the economizer. Draft loss is 2½ in. w.g. through the boiler and economizer. Dust from the collector, the boiler and economizer hoppers and the kiln housing is at present carried by a 9-in. enclosed collecting screw conveyor which transfers to a bucket elevator for discharge into a small surge bin. Dust from the bin is returned to the kiln feed pipe through a screw feeder also powered from the kiln syncro-tie. Actually, the waste heat boiler is delivering over 30,000 lb. of steam per hr. in supplying the requirements for 2000 kw.-hr., with turbines which require 14 lb. of

steam per kw. Full plant load averages about 4000 kv.

Existing G.E. turbines are still in service, consisting of a 4000-kw. unit operating at 150 p.s.i. and 550 deg. F., and two of 1500-kw. rating which operate at 150 p.s.i. and 450 deg. F. so it is necessary to reduce the steam pressure and temperature to the characteristics of the turbine.

Auxiliary steam is supplied by a Combustion Engineering Co. gas- or oil-fired boiler with a capacity of 40,000 lb. of steam per hr. at 750 deg. F. On the average, this boiler is being called upon to produce 5000 lb. of steam per hr. It is always kept operating at a low rate as a guarantee against any shutdown of grinding mills in the event a kiln goes down. When called upon for more steam, the boiler is capable of reaching a 30,000 lb. per hr. rate in just five minutes. A Swartwout de-superheater reduces the pressure of the steam and its temperature, for the turbines. Feed water is heated and de-aerated by a Swartwout feed water heater rated at 125,000 lb. per hr.

Under certain conditions as during the complete shutdown of one of the grinding departments, the turbines require less steam than is produced, even with the auxiliary boiler non-productive. To avoid wear on the safety valves and eliminate the noise of venting steam, a Fisher Power Dump valve with automatic throttling control, followed by a Maxim Silencer, is now being installed. The steam dump valve begins to open when the power station header pressure rises to a pre-set level, and opens fully on an additional 5-lb. rise, when it can vent 45,000 lb. of 450/750 steam per hour. The silencer, measuring 3½ x 13 ft., eliminates all noise. With the power dump valve to vent excess steam to atmosphere and the auxiliary boiler to make up any deficiency, the plant is completely freed of the restrictions usually inherent in waste heat boiler operation.

Kiln Operation

Like in any new installation, operation of the new kiln-boiler setup has presented problems and there have been several changes made as experience was gained.

Initially, no waste dust surge bin was installed, and the design of the waste dust conveyor and elevator proved inadequate. In addition to the surge bin, a Fuller Airslide and pump will be used on the next unit and is planned for the present one.

The practice thus far has been to avoid any great changes in kiln speed which, of course, vary the volume of dust and which is believed to contribute to ring formations. Practice is to change the fuel rate instead and to hold a back end draft at —.40 to —.50 in. w.g. Dust represents 10-20 percent of total feed material. Major changes in kiln draft adjustment are

made by changes to the rheostat on the fan drive motor but ordinary adjustments are automatic.

The single instrument board on the burner's floor has all the kiln instruments and, in addition, those for operation of the clinker cooler and direct-firing coal mill which is held in reserve in the event of shut-off of supply of natural gas.

A Brown Electronik instrument continuously records and indicates r.p.h. of the kiln. There are flashers for the bin feeder and kiln feeder, a tachometer for kiln revolutions and for the kiln feeder and rheostat for making kiln speed changes. Draft is indicated for the front end and the rear end of the kiln by Brown instruments which have a red hand to be set for the automatic holding points desired. There is a draft control selector on the board. A Brown continuous recording electronic potentiometer keeps a record of rear end temperatures and there is a Brown gas flow recorder.

Principal control on the board for the clinker cooler is the automatic grate speed control (undergrate pressure) and, in addition, there is a cooler air indicator, grate pressure controller and meter for cooler fan air flow. Coal mill controls are indicating instruments for the mill suction and exhauster draft and adjustable controller to set coal feed and primary air. Automatic operations in operation now are the rate of kiln feed in proportion to kiln speed, the cooler grate speed and back end draft or front end draft as desired.

Draft is closely maintained. Changes in draft are the principal indicator of kiln ring formation and of load changes. Spot checks are made of O_2 and CO_2 in the exit gases and used as a basis for setting and re-setting the instruments related to combustion. Free oxygen is maintained between 0.5-1.5 percent. Back end temperature of the kiln is maintained at 1400 deg. F. but, due to leakage around the dust seals, is more near 1350 deg. F., upon entering the waste heat boiler inlet.

Natural gas is available at an average heat value of 1050 B.t.u. per cu. ft., but on a dump rate like in most plants, with the result that alternate sources of fuel must be held available in event of shut-off of the gas supply during the winter high-demand months. Supply of gas is unavailable for eight or nine days during the year, if weather is mild, but in cold winters may be shut off for 30-60 days.

Accordingly, a Raymond 493 coal mill is available for standby, driven by a 150-hp. G.E. motor to fire the kiln through a 14-in. burner pipe. The switch can be made without loss of ignition in the kiln. Coal is brought in by rail and fed by pan conveyor to a 48-in. x 48-in. Hammermills, Inc. crusher and is elevated into an overhead bin over the bowl mill. Fineness of grind is 85 percent minus 200-mesh.

Oil is available as another alternate fuel to fire the kiln, and about 15 minutes are required to install the single atomizing burner.

Controls in the powerhouse are centralized at a Hays instrument board, for both the waste heat and auxiliary boilers. Among the factors measured, for the waste heat boilers, are the drafts in the boiler gas inlet and outlet as well as the economizer outlet, steam flow, pressure and temperature (recording), draft loss and exit gas temperature. Draft, temperature and pressure instruments automatically govern operation of the auxiliary boiler except during standby periods.

Orders for the second kiln, boiler, and auxiliaries have already been placed and construction is expected to begin in October, with initial operation of the second unit hoped for in June, 1951.

General Plant Features

Average production from each of the old, short kilns is 675 bbl. of clinker per day. Each kiln has a separate boiler, with no economizer, and all exhaust through a common stack. Fuel consumption is 1,500,000 B.t.u. per bbl. of production.

Raw and finish grinding departments have No. 85 Kominuters for preliminary grinding and 7- x 24-ft. tube mills in closed circuit with mechanical air separators. Raw materials consist of limestone with an analysis of 92 percent $CaCO_3$ and clay from the overburden removed in the quarry. Stone is put through a 42-in. A-C primary crusher, and clay and stone are then processed through hammermills and dryers preparatory to grinding. Fineness of grind is 86-90 percent minus 325-mesh. The plant produces standard portland cement, high early strength portland, air-entraining, moderate low heat and masonry cements.

In addition to the second kiln, reconstruction of over 1000 ft. of bridge craneways will be done during the coming winter months.

Officers and staff members of the company are, Walter H. Wulf, president; P. B. Fegely, assistant to the president; Miss A. M. Barrackman, assistant secretary-treasurer; H. V. Fegely, plant superintendent and production manager; G. M. Shook, chief engineer; O. C. Hasse, chief chemist; V. W. Barlow, general sales manager, and W. D. Clum, traffic manager, all of Humboldt, Kansas. Frank L. Wachter of Kansas City, Mo., is vice-president and Gerald E. Callaway of Peck, Kansas, is secretary-treasurer. W. R. Bendy was consulting engineer for the new installation.

German Cement Exports

EXPORTS OF CEMENT from Germany increased from 105,780 metric tons in 1948 to 352,668 tons in 1949 according to reports of traffic in the Weser River ports.

Durability

(Continued from page 181)

dration products. Some such studies have been made and are being made abroad. Physical chemists in other fields, particularly in geology and metallurgy, have been exploring this science for several years. However, the crystal structures of what are termed the "complex silicates," which certainly include hardened cement and concrete, have been only slightly explored. It is a difficult and intricate process to construct models of crystal structures, and there are said to be very few scientists capable of doing this kind of research in inorganic chemistry—or mineral chemistry.

Most people are more or less familiar with the extraordinary progress made in this field by organic chemists, who are now able to take atoms and molecules apart and reassemble them in almost any designed arrangement. Also, because of the many popular articles on nuclear chemistry, in connection with the A-bomb, many unscientific readers have acquired some of the accepted concepts of atomic structure, and the nature of the bonds between atoms and molecules in a crystal structure.

The crystal structure of silica is fairly well known, and once understood by engineers interested in concrete research, they can readily account for some of the observed peculiarities of silica. It is structurally one of the strongest and most durable minerals in nature, which probably accounts for its abundance in a rather pure state. While the chemical formula of silica is SiO_2, the actual silica cell, or the building block from which all forms of silica come, is SiO_4, a tetrahedron with the Si atom or ion in the center and an O atom or ion at each apex. Every O, however, is also bound to the Si of another group, so that the chemical formula is SiO_2. When a silica crystal is broken, it is necessary to break through a Si-O bond, which is a strong one. Hence, there are no cleavage planes as in some minerals, and the fractured surface is irregular. That, of course, also accounts for the difficulty in grinding silica. The various forms of silica are accounted for by the manner in which the elemental SiO_4 cells are joined together. In quartz they have the closest possible packing, hence quartz is dense and relatively inert. In fibrous silica, such as chalcedony is often described, the SiO_4 cells are connected in infinite long chains or fibers, possibly separated by water molecules, which give it some of its special properties.

Structural chemistry, or the structure of crystals, is studied by X-ray methods, and more recently by the use of electron microscopes, and then an expert builds a model made usually of small balls strung on a wire framework, which in his best judgment would reproduce a duplicate of the X-ray diagrams or photographs from which he works. In the case of com-

plex silicates it may take years to construct such models of crystal structure, but until it is done, it is not possible to say definitely what elements are actually part of a crystal and which are merely adsorbed or caught in the fibrous network or in the interstices between the atoms or molecules. A chemical test is that if water, for example, is really part of the crystal structure or lattice, the lattice will collapse or be radically changed when the water is removed. The lattice structure of silica apparently does not collapse when water is removed from such water-containing cryptocrystalline forms of silica as opal and chert, so that probably they have no real water of crystallization or constitution.

The element aluminum, Al, can substitute for Si in the SiO_4 tetrahedron only when some other element with a valence (or binding power) of 1^- is present to take up the unattached negative 1^- bond in each O atom, since the valence of Al is 3^+ and of Si is 4^+. Common elements which have a valence of 1^+ are sodium, potassium and hydrogen. They must be small enough to fit into the interstices in the crystal structures built up of the tetrahedron cells. The hydrogen atom is so small, on the other hand, that there is no known method of locating it. Where the calcium atom or ion, Ca^{++}, which is the largest constituent of the hydrated cement, fits into the structural framework or lattice in a complex silicate is not known, but so far as we can determine no one has suggested that it can substitute for Si in the tetrahedral cell.

There is one more interesting speculation in connection with the structure of silica we would like to mention here. Since it is composed of SiO_4 cells, the exterior of a particle of silica, however small, has chiefly O atoms exposed, and these outside O atoms or ions have each an unsatisfied negative bonding power (or negative electrical charge) of one. Therefore silica will pick up and hold on its surface any other ion with the opposite or plus charge. Thus two adjacent O ions on the surface of a piece of silica could conceivably collect a calcium ion between them ($O^-\ Ca^{++}\ O^-$). When we consider the enormous surface area exposed in the interior pores and capillaries of a piece of chert, or of cement paste if it should prove to be mainly silica gel, we can see that the Ca ions may be only adsorbed on the surfaces of the pores and capillaries instead of being an actual part of the crystal structure of a hydrated calcium silicate, which would account for its ready removal by leaching with water without destruction of the crystal structure of the enclosing silica.

We mention these things here only to show what an immense and intriguing field lies ahead in the study of the crystal structures of the complex silicates which include cement and concrete.

Unique Kiln Installation

(Continued from page 161)

and that of the shorter kiln will be varied only according to need.

When fired with a single flame at the lower kiln hood, load fluctuations and slurry mud rings were encountered, which is not uncommon to many long-wet process kilns, but since the use of two burners these problems have been eliminated. Production is uniform and the clinker is also uniform in size and characteristics, being about ¼ in. top size. This is due primarily to the character of the raw materials and to a lesser degree to the fact that the auxiliary firing of the long, upper kiln has enabled closer than ordinary control over the conditioning of the clinker.

This has proved an advantage, but there are disadvantages as well in the transfer arrangement. Special alloy end ring castings are required for holding the brick and special alloy castings for the dam at the point of material flow into the 85-ft. kiln. Special steel ends for the kilns, of 25 chrome-20 nickel alloy, are to be installed. Firing therefore must be carefully controlled to avoid damaging these castings.

Rate of feed into the kiln is synchronized through a direct-chain drive from a sprocket on the kiln shell connected to the ferris wheel feeder drive. Exhaust gases are drawn in parallel through three Norblo cyclone dust collectors to exhaust, dust from the collector hoppers being conveyed by screw conveyor to a F-K pump for disposal. The collection fan is rated at 71,000 c.f.m. at 500 deg. F.

The kilns are not highly instrumentalized, the principal instruments being L & N radiation pyrometers at both kiln hoods and Micromax instruments to record the temperatures as measured. The pyrometer for the lower kiln is focussed on the brick lining in the hot zone, according to standard practice, while the other is focussed on the upper wall of the transfer. Draft is maintained at 2.5-3.0 in. w.g. at the back end, which means that the draft is 0.15 in. at the firing hood (lower kiln) and 0.5 in. at the transfer.

Clinker Cooling

Clinker is cooled through two rotary coolers in parallel, one being an 8-ft. 2-in. x 45-ft. Traylor multitube indirect transfer cooler and the other, an 8- x 45-ft. Ruggles-Coles water-cooled cooler. Temperature at discharge is 150-200 deg. F. for direct elevation into clinker storage by bucket elevator. A short elevator transfers the clinker from one cooler into the elevator serving the other unit in delivering into a 5000-bbl. overhead storage bin. This bin has been adapted from the old "silication" tower.

Being a straight-line flow plant, clinker is drawn from the overhead storage into a 1000-bbl. bin from

which it is drawn for grinding into cement. Gypsum is received in railroad cars and transferred by a Barber-Greene car-unloader into an elevator which fills a 250-ton gypsum bin.

A Richardson twin-screw feeder regulates the rate of flow of gypsum from the bin on to a cross belt conveyor which transfers to a second belt conveyor feeding the preliminary clinker grinding mill. The feeders are interlocked to regulate the proportions of clinker and gypsum.

Finish Grinding

The finish grinding department is entirely new and consists of two-stage grinding through Nordberg grinding mills. Preliminary grinding is in open circuit through a 9½- x 11-ft. mill. Product of this mill is elevated and put through an 8½- x 22-ft. tube mill in closed circuit with a 16-ft. mechanical air separator. Circulating load is 200-250 percent, with the rejects returning into the finish mill. The ball mill carries a charge of 80,000 lb. of forged steel grinding balls (2-in. replacement size) and the tube mill, 137,000 lb. of 1¼-in. replacement size. Both mills and the preliminary raw grinding mill have the inching feature for spotting the mills in adding grinding media.

A 6-in. Fuller-Kinyon pump delivers cement into either of nine storage silos of 12,000 bbl. capacity each. Total silo capacity is 120,000 bbl. including the four interstice bins. Cement is packed by two St. Regis 4-spout packing machines, with a 2-way wire mesh conveyor to deliver sacks to cars on railroad sidings on both sides of the packhouse. Cement is handled from silos by screw conveyors and bucket elevators to the packing machine bins which have Tyler Hummer vibrating screens overhead for removal first of any lumps or foreign materials. The new silos and packhouse were built by MacDonald Engineering Co.

Personnel

Howard S. Ponzer is vice-president in charge of operations at Harleyville and also of Giant Portland Cement Co., which operates a plant at Egypt, Penn., in the Lehigh Valley. Carolina Giant Cement Co. is a subsidiary of Giant Portland Cement Co. which has principal offices at Philadelphia, Penn. John A. Philbrick is president of both companies.

R. O. Bartholomew is chief engineer of the two companies and at present is stationed at Harleyville; C. J. Knickerbocker is acting superintendent; D. M. Bean is plant office manager; and Bayne Garner is acting chief chemist.

Australian Cement Output

AUSTRALIAN PORTLAND CEMENT OUTPUT in the 1948-49 fiscal year totaled 1,083,000 long tons, compared with 1,013,000 tons in 1947-48.

Lepol Kiln

(Continued from page 171)

which is placed a Buell cyclone dust collector.

The kiln is 9 ft. 10 in. in diameter and 98 ft. 5 in. long, running on two riding rings. These run on four riding ring rollers, each shaft of which runs in two double self-aligning bearings with scoop lubrication. The kiln is equipped with very efficient air seals at the inlet end from the grate and at the kiln head. The coal firing fan is a Safanco high pressure centrifugal fan. The coal is ground in an airswept tube mill with external air separator. The coal fines are collected in a cyclone and hopper and are fed into the coal firing pipe by a star feeder. The finest coal dust which is not collected in the cyclone is blown into the kiln with the primary air. This arrangement allows for a storage capacity of pulverized coal in case of breakdowns in the mill.

The rotary cooler is 8 ft. 3 in. in diameter and 64 ft. 4 in. long. It is equipped in the first third of its length with firebrick, the second third with firebrick and lifters and the last third with a butterfly arrangement, cooling the clinker very efficiently. Otherwise it is similar in construction to the rotary kiln.

A Jeffrey electric vibrating feeder 35 ft. long conveys the clinker to a pit in the clinker storage area of the raw material building, from where it is handled by the overhead crane.

One Jeffrey Waytrol No. 330 feeder feeds the clinker and a No. 220 feeder feeds the gypsum into the cement mill. This is an E.M.C. 3-compartment mill, 7 ft. 3 in. x 42 ft. 6 in., driven by a 700-hp. synchronous motor. Between the second and third compartments are diaphragms, between which additional cooling air, free from moisture, heat and dust, is admitted. This is drawn through the induced draft fan of the bag-type dust filter.

Storage Silos

The cement is taken by a 10-in. air conveying trough to the Cera pump, a double vessel automatic pneumatic pump, which forces the cement into four storages silos 25 ft. 6 in. diameter x 60 ft. high. These flat bottom circular silos are all equipped with aerating tiles and discharge troughs. The latter are connected to pneumatic discharge valves.

From there the cement is brought in 10-in. air conveying troughs to the bucket elevator feeding the surge bin of two Bates 2-spout packers. A conveying belt takes the 94-lb. paper bags to the railroad car or to the trucks.

The design of the plant, its manufacture and erection, including design of structural steel and reinforced concrete buildings and silos, were carried out under the supervision of L. M. Baerveldt, who for 20 years was formerly resident engineer in South Africa for G. Polysius, Germany.

Licking a Clay Problem

(Continued from page 111)

gravel is put into a small tank and other sizes are piled around it. This has proved to be a good method of getting an additional size of material in the reclaimed area.

The company has a Diamond portable plant and also a semi-portable plant for use on larger construction jobs. A total of eight cranes and/or draglines are used: one P&H, one Lorain, one Bay City, and five Northwests.

Tailings or rejects from the sand wheels are discharged into a channel where much of the material settles and is bailed out to storage piles alongside the channel. This material is sold for fill purposes. The balance of the tailings flows to a settling area where some low ground is being built up. It eventually will be high enough to be used for industrial purposes.

The company has a well equipped shop for maintenance and repairs. Most of the plant's needs are fabricated at the plant and at time of inspection six steel field hoppers were about completed. All material is shipped by truck and about 50 percent of these are company owned. Caudell & Johnson have an affiliate company, the San Diego Transit-Mixed Concrete Co. with 25 mixer trucks serving the area. J. H. Caudell is associated with Mr. Johnson in the corporation. S. H. Moore is manager of the transit-mixed concrete business.

Dewey's Expansion

(Continued from page 109)

construction program; Kelsoe Burnett Electric Co., also of Chicago, was electrical contractor, and Rock Island Bridge and Iron Co. and Dubuque Plumbing and Heating Co. were subcontractors for the structural steel work and piping, respectively.

Personnel

Fred B. Hunt is works manager; E. S. Ernst, assistant works manager and chief chemist; George R. Cross, general mill foreman; C. E. Hartwig, combustion engineer; Harold Egger, plant engineer; G. N. Roop, master mechanic, and N. D. Armentrout, quarry superintendent. C. R. Babcock is electrical foreman.

Dewey Portland Cement Co.'s principal offices are at Kansas City, Mo., and it also operates a dry process mill at Dewey, Okla. Principal officers are Frank E. Tyler, chairman; W. E. Tyler, president; D. M. Tyler, first vice-president; L. J. Capen, vice-president (sales); W. H. Gray, vice-president (sales); R. W. Moore, vice-president and secretary, and M. V. Ward, treasurer.

Brazilian Cement

BRAZILIAN portland cement output totaled 1,110,503 metric tons in 1948, compared with 913,525 tons in 1947.

Labor Relations Trends

(Continued from page 95)

ments with unions, should give at least as much attention to the contract provisions of our agreement, as they do to the more dramatic wage and benefit provisions."

In his concluding remarks Mr. Wilson outlined a philosophy for industry, that all American producers and manufacturers could well adopt and religiously carry out. He said: "The problem is to work out an American solution for the relations of labor and industry, and not attempt to adopt the philosophy of class conflict from Europe, either from Communists and Socialists on the one hand or the cartel-thinking, non-competitive reactionaries on the other. A continuation of shot-gun bargaining, on the pattern familiar in the coal industry, certainly will not contribute to the prosperity of our country or satisfy our people.

"Certainly General Motors believes in free enterprise, in producing more and better things for more people and in serving customers well. It also believes in fair treatment of its employes and holds this is not in conflict with treating customers right. Any business that expects to show good profits should attempt to earn them through efficiency and progress and not just by collecting a toll. It sometimes seems to me that some people who talk free enterprise intend it for others and are reluctant to face competition themselves. Some even seem to use free enterprise talk as a cloak for a little extra selfishness.

"We do not expect this agreement to set a pattern of so many cents per hour or so many dollars a month in the form of a pension nor in the form of certain insurance benefits intended to improve the health of the worker and his family. It is our hope that this agreement will set a pattern for bargaining based on principles that will insure industrial peace and prosperity and minimize strife and industrial warfare."

PRODUCTION of cement in Denmark reached approximately 900,000 metric tons in 1949, 7 percent more than in 1948.

CONCRETE PRODUCTS

A SECTION OF ROCK PRODUCTS

CONCRETE UNITS · READY-MIXED CONCRETE

Ready-mixed concrete plant of Eberts Brothers Co., Wyandotte, Mich.

You hear it from coast to coast.*..

"It's Blue Brutes For My Money!"

***OREGON**

It's another Blue Brute UMW Wagon Drill. Ready to swing into action at any angle, it is here helping to cut through a road cut where the timber grows tallest. The Kuckenberg Construction Company of Portland, Ore., are the owners and the report from this firm says they **"wish all their other machines on the job were as good . . . and are going to change to Blue Brutes in future replacements."**

***PENNSYLVANIA**

A 315' Portable Compressor and UMW Wagon Drill, one of many Blue Brute teams owned by Cramer Construction Co. of Lebanon, Pa. Pres. G. B. Cramer writes: **"We have used Blue Brutes for several years, and on our Lebanon Veterans' Hospital job have five Blue Brute Compressors powering Worthington Wagon Drills and Rock Hammers. As evidence of their entirely satisfactory performance we recently purchased another 315' Blue Brute Compressor."**

***OHIO**

In Waterville, Ohio, the Crawford Steel Construction Co., Inc., of Cincinnati, erected the structural steel on the new highway bridge across the Maumee River. Company official J. A. Crawford says: **"Our 210' Blue Brute Compresser is efficient, well constructed and rugged. It has given us excellent service, and we are more than willing to recommend it highly . . . This first experience with your products is evidence to us of Blue Brutes' superiority.**

***WISCONSIN**

Opening up a new limestone quarry in Sussex, Wisconsin, is easy work for these rugged, hard-hitting Blue Brute team-mates. The fast, versatile UMW Wagon Drill is drilling 6-foot holes for explosive charges. Power source is a 315' Blue Brute Compressor, that gets all the air out of every drop of fuel. Vice-President Lloyd Wolf of the Quality Limestone Corporation, reports: **"After thorough investigation we decided Worthington equipment was best . . . They are fine machines."**

From the Atlantic to the Pacific you'll find Blue Brute owners — on every type of construction project, from the smallest to the largest — glad to tell you of the cost-cutting, trouble-free performance that is helping make estimates pay handsomely.

There are a lot of sound reasons for this country-wide acclaim — all adding up to the fact that *there's more worth in Worthington*. Your nearby Worthington-Blue Brute Distributor is ready with those reasons, and can make immediate deliveries. See him, or write us direct.

Worthington Pump and Machinery Corporation
Construction Equipment Department
Harrison, New Jersey

Distributors In All Principal Cities

WORTHINGTON

BUY BLUE BRUTES

HO.5

IF IT'S A CONSTRUCTION JOB, IT'S A BLUE BRUTE JOB

INDUSTRY NEWS

CONCRETE PRODUCTS CO., Rupert, Ida., has announced that an office and sales yard will be opened in Burley. Pumice building block and concrete pipe and tile will be handled. The materials will be trucked from the company's plants at Rupert, Idaho Falls and Pocatello.

ZANE BRIKCRETE AND DUNSTONE CO. INC., Zanesville, Ohio, is producing Brikcrete and Dunstone, at a capacity of 17,000 units per day. John F. Hanifan, Jr., and Maxwell Fox are managers.

CONOTEX CO., Abilene, Tex., is constructing a $150,000 concrete block plant which will have a capacity of approximately 18,000 units per day.

HAROLD HORST has announced plans to construct a concrete block plant at Hudson, S. D., which will have a capacity of 1000 block per day.

ARNOLD REITH AND JEROME SLIPSAGER have started production of concrete block at Palmer, Kan.

MERCHANTS TRANSFER, Sandpoint, Idaho, has opened a premix plant. Henry J. Holien is the owner.

MASSEY CONCRETE PRODUCTS CO., has started construction of a plant near Blue Island, Ill., for the production of structural concrete products.

WILSON FUEL AND SUPPLY, Alliance, Ohio, has installed new equipment designed for speedily controlled batching with a minimum of dust and noise. The company has entirely replaced its plant four times in the last 13 years to keep abreast of expanding demand. Paul A. Kintz is president of the firm.

ZUFELT READY-MIXED CONCRETE CO., Mesa, Ariz., is building a new addition to its plant.

HAYES & BURLESON READY-MIX CONCRETE CO., Santa Fe., N. M., is now under the ownership of John Murchson, Robert Thompson, and Bill Brewer. The firm will operate under the name of The Quickmix Co. at the present location until a new plant can be erected.

CENTRAL PRODUCTS CORP., Cape Girardeau, Mo., a ready-mixed concrete plant, has been erected by Burton J. Gerhart.

TITUS, INC., Jerome, Idaho, a new ready-mixed concrete operation, has been opened by Marvin Harp.

RICHTER CONCRETE CORP., Covington, Ky., has acquired the ready-mixed concrete business of Byrnes-Conway Co. The transaction includes purchase of all trucks and leasing of the St. Bernard plant. Richter Concrete has completed and is now putting into operation a new concrete mixing plant in Bridgetown and is constructing another new plant in Bond Hill.

DUNN BROTHERS, Pinckneyville, Ill., have opened a ready-mixed concrete plant near St. John with a capacity of 100 cu. yd. per 8-hr. day. Robert Willis will be manager of the operation.

Detroit Builders' Show

THE CONCRETE PRODUCTS ASSOCIATION of Detroit emphasized the fire safety, comfort, beauty, low first cost, durability and minimum maintenance characteristics of concrete masonry units in home construction at the 1950 Detroit Home Builders Show held recently.

A portion of the emphasis was provided by the issue of 50,000 copies of a specially prepared pamphlet which contained photographs and floor plans of homes selected from the work of four qualified builders of concrete masonry in the Detroit area. Also included in the pamphlets was information setting forth some well established advantages of the product. A display of various types of units produced by member companies provided further emphasis. The structure in the foreground of the illustration was built of sand and gravel block. The rear wall was built of cinder block, as were the projecting wing walls. Each of four wall panels was painted a different color, using standard cement paint.

Coupons were distributed at the show which entitled visitors to a chance to win enough concrete masonry units to build any one of the homes exhibited, or units to the total value of $250 if the winner did not choose to build one of the homes displayed. Attendance at the show was approximately 350,000 during the ten-day period. Approximately 35,000 people entered the coupon contest.

The builders of the homes exhibited helped defray the cost of the exhibit by paying an established charge per page of the pamphlet. On the basis of coupons deposited, the publicity cost to builders amounted to slightly less than one cent per contact. Three houses of the kind exhibited were sold in less than two weeks time after the show ended; these sales were traced directly to the builders show, attesting to its success.

Wins Home Show Prize

BUEHNER CINDER BLOCK CO., Salt Lake City, Utah, was awarded grand prize for its display at the Utah Home Show. The winning display was composed of two rooms showing various methods of using the company's products in construction and decoration of a home.

Raised-Slab Building Method

TEXSTAR CORP., San Antonio, Tex., discussed results of the first large-scale commercial use of the new "raised-slab" Youtz-Slick Method at a recent meeting. The method, developed by the Institute of Inventive Research, eliminates forms for concrete slabs at upper story and roof levels by pouring concrete on separating mediums on the ground, and then raising the slabs into place on steel columns with specially designed automatic lifting equipment, according to the company which is a licensing agent for the method. It was used on the new administration building for Trinity University of San Antonio.

Marble-Faced Block

ARTHUR P. LAMNECK, JR., Columbus, Ohio, has been appointed executive franchise distributor for the manufacture and sale of Knighton marble-faced concrete block in Ohio, Indiana, Illinois, Michigan, Wisconsin and Texas. The marble face is made on the block at the same time the block is made, and comes in a variety of colors and types of surfaces.

Exhibit of concrete masonry home construction presented at recent Detroit Home Builders Show

Seal GUARANTEED for one year

The seal between the revolving hopper and the mixing drum is never broken! Blaw-Knox guarantees the seal on the Hi-Boy Trukmixer for one year, providing it is greased daily. It's the end of tailgate trouble!

Only on BLAW-KNOX Hi-Boy TRUKMIXERS

NO DISCHARGE DOOR!
No possibility of segregation, because there's no door to provide a means of segregation during discharge.

★ ***FREE DISCHARGE WITHOUT SEGREGATION***

Discharge speed is controlled by the rotation of the drum . . . a handful or the whole load *without segregation.* Wide flanged discharge blades extending past the end of the unrestricted 32" drum opening give high speed, uniform discharge even with zero slump concrete.

★ ***UNIFORM, THOROUGH MIXING***

Deep spiral mixing blades and the big auxiliary blades turn the batch over and over, quickly producing a thorough, uniform mix even when zero slump concrete is specified.

★ ***CONSISTENTLY LOW MAINTENANCE***

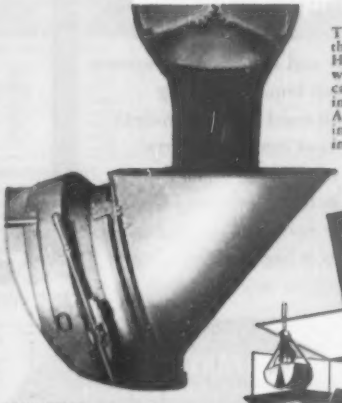
Seal failure and leakage of grout or water are eliminated once and for all! The Hi-Boy has the *only* rear end hopper seal that operates safely while submerged in concrete. When a worn seal does have to be replaced, it can be done easily in 30 or 40 minutes.

★ ***HIGH DAILY PAYLOAD AVERAGE***

Only a rear end hopper gives you faster charging, an initial mix while charging, instantaneous shrinkage of the batch and greater capacity. The Hi-Boy assures a high daily payload average and a *high daily profit* on every job.

SPLIT-SECOND CHARGING

The Revolving Hopper permits the fastest charging you ever saw. Hold the batcher discharge gate wide open . . . the materials cascade through the big drum opening and start mixing immediately. A flick of the latch automatically inverts the hopper for discharging in three seconds.



WRITE for details about the BLAW-KNOX Ready-Mix "Complete Package"

SEE YOUR NEAREST BLAW-KNOX HI-BOY DISTRIBUTOR FOR COMPLETE INFORMATION

BLAW-KNOX

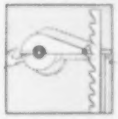
BLAW-KNOX DIVISION of Blaw-Knox Company
Farmers Bank Bldg., Pittsburgh 22, Pa.

A MASONRY SAW MUST Have ALL THESE FEATURES for Guaranteed Performance

PATENTED
Automatic Blade Pressure

● Makes your blades last longer. Because Equalizer Spring automatically cushions blade pressure whether cutting HARD or SOFT materials. Outstanding for blade economy.

PATENTED
Select-A-Notch



● One man easily adjusts Cutting Head to desired height . . . Whether cutting 12" or 1" material. Operator's hands merely guide. All weight is supported by rear Connecting Bar.

PATENTED
Adjust-A-Cut Control

● Merely pull the knob — and the Cutting Head is free for finger-tip setting at any desired angle. Release the Knob — and Head is locked in the desired position.

PATENTED
One-Spot Operation

● From ONE SPOT at the front of his Clipper Saw the Operator performs every cutting operation and makes every saw adjustment. Never leaves his operating position.

"Wet or Dry" Pump

● No need to remove belt when cutting dry. No maintenance. Factory Sealed. An exclusive Clipper development. Patented Water Application Unit controls water flow.

ONLY Clipper HAS THEM ALL

9 MODELS
Priced from $195

by the ORIGINATORS *of*
MASONRY SAWS

Only Clipper guarantees "To provide the fastest cut . . . At the lowest cost . . . With the greatest ease . . . Any time . . . Any where . . ." because ONLY Clipper has ALL the vital saw features illustrated and described on this page. The most important of these features that make possible instant portability, complete flexibility, and smooth, sensitive cutting performance are exclusively Clipper.

Cut WET or DRY
The 100% ANSWER

The new Model HD Clipper, because it cuts WET and DRY, answers every masonry cutting problem. No need to disconnect the Pump V-Belt in switching from wet to dry cutting. The Clipper "WET OR DRY" Pump cannot be harmed by dry cutting.

CLIPPER SUPERIOR ABRASIVE BLADES
CLIPPER BONDED DIAMOND BLADES

37 separate and distinct Clipper DRY Cutting Abrasive and WET Abrasive Blades—and 19 different types of Clipper Diamond Blades provide you with the absolutely correct blade specifications for any type of cut on every type of material.

SOLD DIRECT FROM ONLY FACTORY TO USER

What the Famous Clipper FREE TRIAL Guarantees You

The famous 13-year old Clipper FREE TRIAL Guarantee still enables the user to prove by actual use the amazing money-making efficiency of a Clipper Saw right on the job—SMALL or LARGE—on any masonry material.

NATURAL STONE

ANY Masonry material regardless of hardness is easily cut in SECONDS WITH CLIPPER

GLAZED TILE

CONCRETE BLOCK

FIRE BRICK

Portability

● Two easy to handle pieces — the Cutting Head and Saw Frame — are dismantled in seconds and easily moved from one location to another.

Stabilizer Control

Just turn handle to lock Head for fixed diamond blade cutting. A safety "lock when transporting saw as a unit.

Water Application

Patented Water Application Unit systematically controls water flow.

Ball Bearing Cart

Self aligning—streamlined—ball bearing Conveyor Cart with Adjustable Stop and Rule for swift accurate measurements.

Adjustable Cart

Handy accessory clamps material instantly in any desired position for cutting special shapes.

Snap-On Blade Guard

An outstanding safety feature. Increases Operator comfort by eliminating spray when cutting wet.

Dust Proof Motor

Packed with power, special masonry cutting Motor totally enclosed, dust and water proof.

The ORIGINAL Masonry Saw

DIRECT FROM FACTORY TO USER

Clipper "SAWS RIGHT THRU"

NATION WIDE DIRECT FACTORY SERVICE

MANUFACTURING CO.
KANSAS CITY 8, MISSOURI
Cable Address: CLIPPER K. C. Mo.
PHILADELPHIA • ST. LOUIS • CLEVELAND • AUSTIN, TEX.
SAN FRANCISCO • CHICAGO • NEW YORK • PITTSBURGH

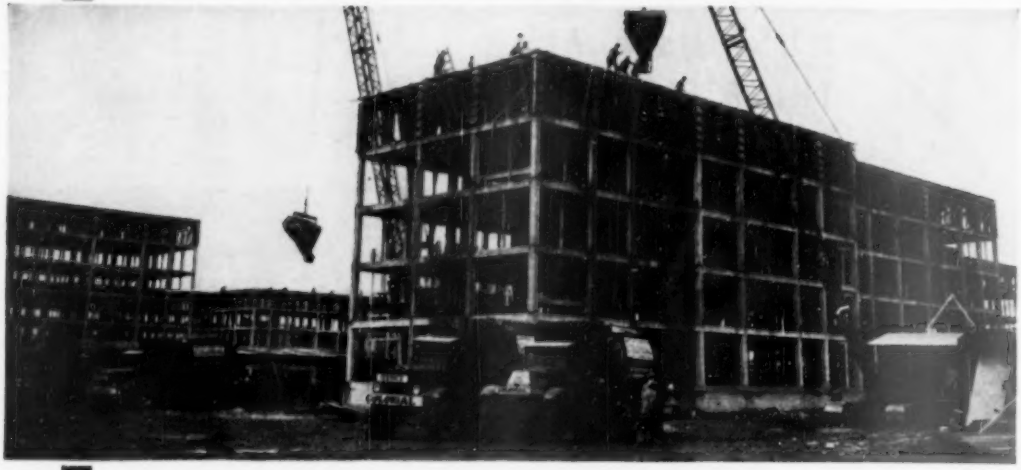
CUT WET or CUT DRY
There's a Clipper Blade for Every Job!

MAIL THE COUPON NOW!

CLIPPER MANUFACTURING COMPANY
2807 S.W. WARWICK · KANSAS CITY 8, MISSOURI
Send TODAY information on the FREE TRIAL offer and complete literature and prices on the 1950 Clipper Masonry Saws.

NAME _____
COMPANY _____
STREET _____
CITY _____ ZONE _____
STATE _____

HERE'S WHY THEY ASK FOR 'INCOR'



High-Efficiency 'Incor' Performance

Speeds Erection of Ravenswood Houses—West Section

NEW YORK CITY HOUSING AUTHORITY
RAVENSWOOD HOUSES (West Section) Long Island City

Architect: **THE FIRM OF FREDERICK G. FROST,** New York

Ready-Mix 'Incor' Concrete
COLONIAL SAND & STONE CO., INC., New York

Contractor, Concrete Frame:
CAYE CONSTRUCTION CO., INC., Brooklyn, N. Y.

● One of New York City Housing Authority's largest projects is 2166-apartment Ravenswood Houses, Long Island City. Housing Authority projects are quality-constructed in every last detail—and they move ahead at driving speed. Because at today's costs, time saved is money saved—and how!

All last winter, frame concreting on the fourteen 6-story units in Ravenswood's west section clicked ahead on precise schedule—for CAYE CONSTRUCTION CO., INC. switched to 'Incor' 24-Hour Cement. In cold weather, column forms were stripped in 24 hours, slabs in 48 hours. That kept the job right on schedule—and saved a complete set of forms. *Big money, that, at today's form costs!*

Came Spring—and things were running so smoothly that they kept on using 'Incor'. For high-efficiency 'Incor' performance knows no season. Straight around the calendar, 'Incor' promotes the smooth-running, time-saving efficiency on which today's close-margin profits depend.

Another reason why the nation's leading Ready-Mix Operators make 'Incor'* concrete available at all times—for customers' time-and-money-saving convenience.

*Reg. U. S. Pat. Off.

LONE STAR CEMENTS COVER THE ENTIRE CONSTRUCTION FIELD

LONE STAR CEMENT CORPORATION

Offices: ALBANY • BETHLEHEM, PA. • BIRMINGHAM • BOSTON
CHICAGO • DALLAS • HOUSTON • INDIANAPOLIS • JACKSON, MISS.
KANSAS CITY, MO. • NEW ORLEANS • NEW YORK • NORFOLK
ST. LOUIS • PHILADELPHIA • WASHINGTON, D. C.

LONE STAR CEMENT, WITH ITS SUBSIDIARIES, IS ONE OF THE WORLD'S LARGEST CEMENT PRODUCERS: 15 MODERN MILLS, 27,500,000 BARRELS ANNUAL CAPACITY

Plant of Rocklite Products. Block machine is situated on ground floor of structure. Expanded clay used as lightweight aggregate is taken from mountain side at right

Lightweight Expanded Clay Aggregate for Precast and Monolithic Concrete

Rocklite Products produces own aggregate in rotary kilns and merchandises concrete products through sales organization of large gravel producer

By WALTER B. LENHART

THE PLANT OF ROCKLITE PRODUCTS located near the outskirts of Ventura, Calif., started operations in mid-1947 producing precast concrete masonry units. The company took its name from a calcined shale lightweight aggregate that was manufactured by another company adjacent to the newer block plant. Later, Rocklite Products took over the aggregate producing plant, which it now operates. Because of the exceptional and excellent properties of the coated shale aggregate and skill in its use for producing masonry units, combined with sales aggressiveness, the company has become an important one in southern California.

Diversified Uses

The use of Rocklite is not confined to precast units, for the company is finding an extended use for the material in monolithic concrete. A good example of this use in California is the state capitol annex building now under construction at Sacramento. The haul to Sacramento is 450 miles. On this job concrete weighing 90 lb. per cu. ft. with 2500 p.s.i. strength at 28 days with 6-in. slump is specified. With 5¾ bags of cement per cu. yd., 3000 p.s.i. concrete is easily made, it is pointed out. The entire building is constructed of Rocklite; floors, walls and roof slabs involve some 17,000 cu. yd. of concrete. Pouring is at the rate of 1000 to 1200 cu. yd. per week.

Source

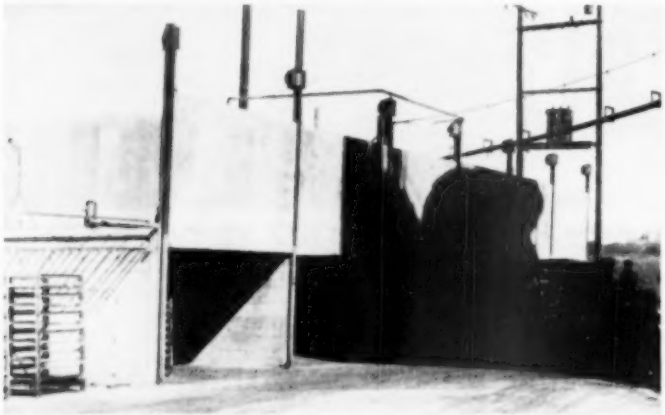
Rocklite aggregate is produced from a natural blue shale that is secured from large deposits adjacent to the plant. After crushing and screening, the raw material is expanded in three 8- x 125-ft. rotary kilns. Natural gas or preheated oil is used. The plant can produce 450 to 500 cu. yd. per 24-hr. day. The company produces Rocklite aggregate in size gradations from 1 in. down, including a Rocklite sand. The latter is a minus 6-mesh product that contains about 8 percent minus 100-mesh material. In addition the company produces three other special sizes: a roofing granule, a lightweight acoustical plaster that is competing successfully with other plastering materials, and a lightweight material for gunite work.

Rocklite aggregates weigh as follows:

1 in.	1000 lb. per cu. yd.
9/16 in.	1200 lb. per cu. yd.
5/16 in.	1500 lb. per cu. yd.
Sand	1700 lb. per cu. yd.

Rocklite used for monolithic and for precast masonry units is a brown tinted, cellular, lightweight aggregate that has a very hard, but smooth coated surface. The interior of each particle is a mass of tiny cells. The outer

After steam curing, block are stored in yard for at least 30 days. No less than 1,000,000 block are kept on hand at all times. The entire yard is paved



Six curing rooms are open at both ends. The block machine is located in front of these for convenience

Lightweight units coming off automatic block machine

coating of the particle is a dense skin that is so hard it will scratch glass. It has exceptional bonding properties with portland cement paste. The manufacturer points out that by having a rounded, sealed outer surface on the aggregate, cement paste remains coated on the surface where it is used to maximum efficiency.

The question of whether to prewet Rocklite lightweight aggregate is not an important one as the outer coating prevents undue absorption of the liquid. Rocklite can be mixed dry with the portland cement, and the water added later if desired.

Test Results

The Bureau of Reclamation recently published test results summarizing work done on western lightweight aggregates, and in this paper Rocklite was called an "expanded-coated shale and clay" and was designated "Sample No. 1." The pamphlet compares the many types of lightweight aggregates found in the West and Rocklite appears to have many exceptional properties. The paper is No. 45-34, by Walter H. Price and William A. Cordon, and was published by the American Concrete Institute.

The block plant operated by Rocklite Products features three Besser Vibrapacs. It is so designed that more machines can be added when desired. The block are cured in one of six steam kilns, after which they are stored in a 9-acre paved yard and cured for an additional 30 days. The company makes it a practice to keep at least a million structural units on hand at all times. This involves about 100 different sizes and types of Rocklite precast masonry units. These include a full line of modular architectural and structural units of the conventional types, besides pilaster units, U-beams, sill blocks, slabs, veneers, brick, etc. The company also handles a full line in modular sizes of steel and aluminum sash, as well as waterproofing paint. This masonry paint is made under the firm's own formula. Reinforcing rods and bagged cement partially complete the list of building materials sold here.

Rocklite block are delivered from the plant by trucks for distances as far as 250 miles. Eighteen to twenty ton loads are hauled with flat-rack semi-trailer jobs. A standard 8-in. block weighs 25 pounds, so on this basis about 1450 block are hauled per load.

Block Plant

The block plant and yard are very attractive. The former is an 80-ft. high steel structure and consists of bunkers over the block machines that hold a total of 650 cu. yd. of material. There are eight compartments here, two for each machine. The six curing tunnels are 80 ft. long each and are open at both ends. The doors on the kilns are the vertical, counterweight type and have a piece of rubber hose

fastened to the bottom edge to help retain the steam. Steam is supplied from a battery of two Cleaver-Brooks, fully automatic, oil-fired, steam generators mounted on the roof of the kilns. Near the block machines, steel plates have been set in the pavement to take up the wear of lift trucks. The plant uses a total of eight Clark fork lift trucks equipped with especially designed block handling forks.

Toledo dial scales are used on the batchers and cement weighing equipment, there being a total of four of these units. The three 50-cu. ft. Besser mixers are located on the floor directly above the block machines. Cement is delivered to the plant from Victorville, Calif. in bulk truck equipment and is elevated to a cylindrical steel silo by a bucket elevator. The silo is divided into two sections about midway with a horizontal partition. Cement is stored in the lower compartment, and is transferred into the upper tank as needed. The silo has a total capacity of 5000 cu. ft. The entire plant is painted aluminum.

Officers

Officers of Rocklite Products are all members of the executive and operating staff of the Basalt Rock Co. of Napa, Calif. E. F. Brovelli is president of Rocklite, M. M. McIntyre is vice-president, John R. Anderson is secretary and treasurer, and Don McCall is chief engineer. A. G. Streblow, president of Basalt Rock Co., Napa, Calif., is a director of this company.

E. A. Peterson is general manager with offices at the Ventura plant. John Meloni and A. W. Maxwell handle the aggregate plant production, and Luther Frame is block plant superintendent.

Sales for Rocklite masonry units in the Los Angeles area are through the Consolidated Rock Products Co. of Los Angeles, one of the largest firms of its type in the United States. Rocklite Products confines its own direct sales effort to counties north of Los Angeles. Aggregate sales are also handled direct from the plant office.

•

LAWTON TRANSIT-MIX, Lawton, Okla., has announced that Fred G. Hammond has purchased an interest in the firm. Mr. Hammond was recently associated with the Wilson Concrete firm.

BURLEY CONCRETE PRODUCTS Co., Burley, Idaho, has been established to manufacture about 67 different types of block, and 15 different sizes and types of headgates. Lyle F. Walton is owner of the business.

SOUTHEASTERN CONCRETE PRODUCTS Co., Cayce, S. C., plans construction of a plant near Swannanoa to produce concrete block, brick and culvert pipe. Lightweight aggregate also will be produced. W. R. Carson, company president, estimated that the $150,000 plant will be ready to begin operations in August. Grayson W. Adams will manage the new plant.

General view of plant office

Control of Efflorescence in Colored Concrete Products

EFFLORESCENCE, or bloom as it is commonly known, is the grayish white scum of varying concentration which forms on the surface of concrete products. Chemically, the efflorescence consists mainly of the partly soluble alkali metal salts which are bled to the surface of the product by capillary action during and after the curing period, and deposited there when the water evaporates. Efflorescence is present in all concrete products but is seldom noticed in uncolored mixes due to the lack of contrast between the grayish white bloom and the grayish white concrete. However, when the product has been colored by the introduction of an inert pigment, the efflorescence is readily seen against the contrasting background.

There are quite a few factors which contribute to the amount of efflorescence. The most important of these is the amount of soluble salts present in the concrete. These salts are mainly calcium, magnesium, iron and other metal sulfates and chlorides and are present in different quantities in all the components of concrete. The following table will illustrate a typical analysis of water soluble materials in colored concrete ingredients:

Pigment ....0.30 percent water soluble
Sand .....0.30 percent water soluble
Lime .....0.67 percent water soluble
Water .....0.20 percent water soluble
Cement ....2.00 percent water soluble

Using these figures in a typical concrete product formulation we can determine the important sources of the water soluble material.

Formula		Percent water soluble in ingredient	Total weight water soluble from each ingredient	Percent water soluble from each ingredient in total mix
Pigment	6 lb.	0.3	0.018 lb.	0.4
Cement	96 lb.	2.0	1.920 lb.	42.7
Sand	820 lb.	0.3	2.460 lb.	54.7
Water	50 lb.	0.2	0.100 lb.	2.2
			4.498 lb.	100.0

From this table it is obvious that the great majority (97.4 percent) of water soluble salts contributing to efflorescence are present in the sand and cement. These figures are a specific example. They will vary a great deal in different localities due to variations in sand deposits, water impurity and cement supply. Among pigments available, that of the Mineral Pigments Corp. has a water soluble content that is accurately held to very close limits. It should be noted that of all the efflorescence contributing materials, this pigment has the smallest effect of only 0.4 percent.

We now have seen the sources of the undesirable soluble salts. In order for these salts to cause efflorescence they must be carried to the surface of the concrete product while in solution, and deposited on the surface when the water is evaporated. There are several outside factors which determine the amount of these salts which are carried to the surface. First, the quantity in solution is important. Since most of these salts are partially soluble, only a certain quantity will go into solution with a limited amount of water. Therefore, the greater the amount of water in a product the greater the amount of salts in solution. Time also determines the quantity which goes into solution. The longer the salts are in contact with water the greater the amount that will dissolve, up to the limits of solubility; consequently, the longer it takes the excess water to evaporate from a product, the greater the efflorescence.

The above factors determine the amount of salts dissolved. Before these dissolved salts can cause efflorescence they must be carried to the surface. In the curing process of a concrete product the excess moisture is evaporated at the surface only. As the surface moisture is evaporated, it is replaced with moisture from the interior by means of the capillaries formed between the particles in the

(Continued on page 238)

General view of open air pumice block plant

Superlite Corp., subsidiary of Builders Supply Corp., Phoenix, has new plant at Calipatria, Calif., with controls that govern batching, conveying to mixer, mixing time, and dumping of material to belt serving block machine in sequence

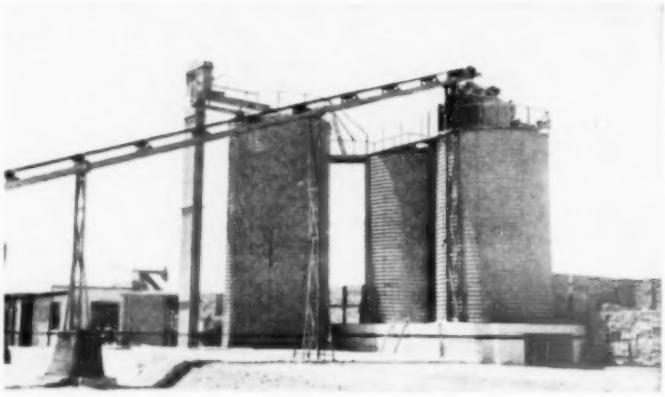
By WALTER B. LENHART

Automatic Block Plant Operation

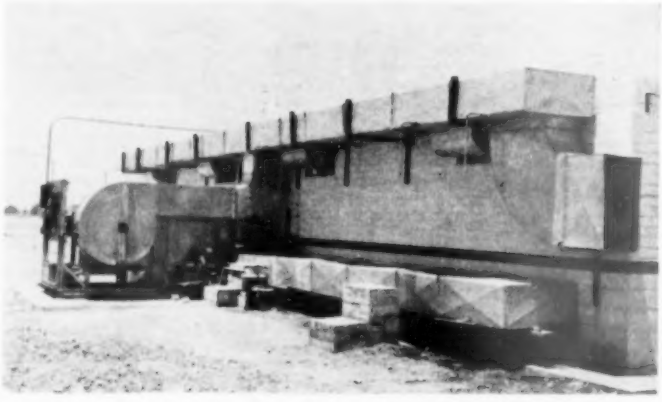
QUITE CLOSE TO the southern edge of the Salton Sea is the town of Calipatria, some 210 ft. *below* sea level. With flat, irrigated, productive soil it is centrally located in an area where agricultural productivity is not appreciated by most people who, when the area is mentioned, shrug their shoulders and say, "too hot." West of Calipatria and closer to the Salton Sea are several "buttes," or elevated land structures that seem to poke up through the flat, desert land. Some of the buttes are pumice and could be of recent geological age, for a mile or so from them are several hot, boiling mud pools that are in practically continuous though mild eruption.

New Operations

Over in Arizona, at Phoenix, is located the Builders Supply Corp. which has been making and selling pumice masonry block for many years. ROCK PRODUCTS has had, from time to time, descriptive articles on the Phoenix operations. For a year or more that company has operated an affiliate known as Superlite Products. This company produces the pumice at Calipatria for the parent company, so the value of the raw material has been long demonstrated. What is new is the extension of Builders Supply Corp.'s activities into the Imperial-Coachella valley through the construction of a modern and efficient block plant in the little town of Calipatria. The parent company also is building a new concrete masonry plant at Albuquerque, N. M. At the time of inspection, the Calipatria operation was seven weeks old. It operates under the name of the Superlite Corp. Thus, as new communities are born on this vast western desert, the rock products industries move in and supply the



Three corrugated silos for aggregate and bulk cement



Gas-fired semi-automatic steam plant

basic materials, the foundations of any economy.

The new block plant ships both by truck and by rail with the Southern Pacific serving the area. The company is supplying local points as well as many more distant: Parker, Ariz., some 185 miles northerly and reached only by trucks; Yuma, Ariz.; and Banning and San Diego, Calif.

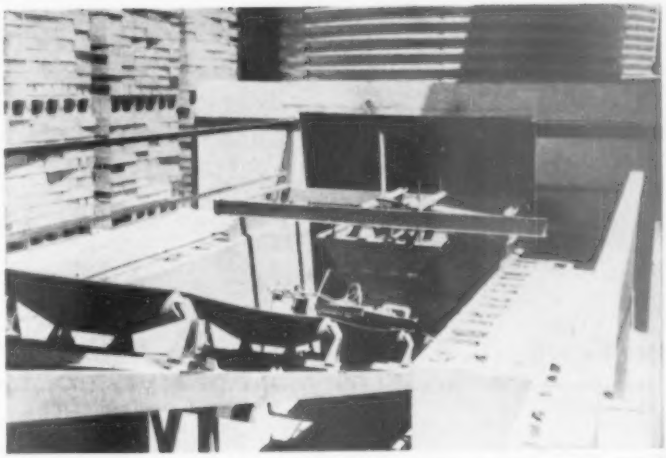
The plant, like most in the Southwest, is in the open. There are two silos for pumice with a small vibrating screen mounted on top so that in addition to the sizing the pumice receives at the affiliated pumice mining operation, additional and closer sizing can be done here. A bulk silo is provided for the cement.

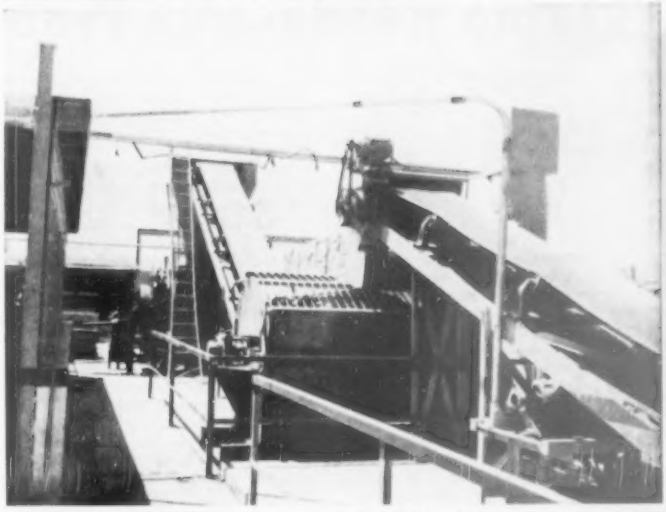
The portland cement is weighed but the pumice aggregates are batched on a volume basis. Sizes of pumice in the minus ⅜-in. range seem to be favored.

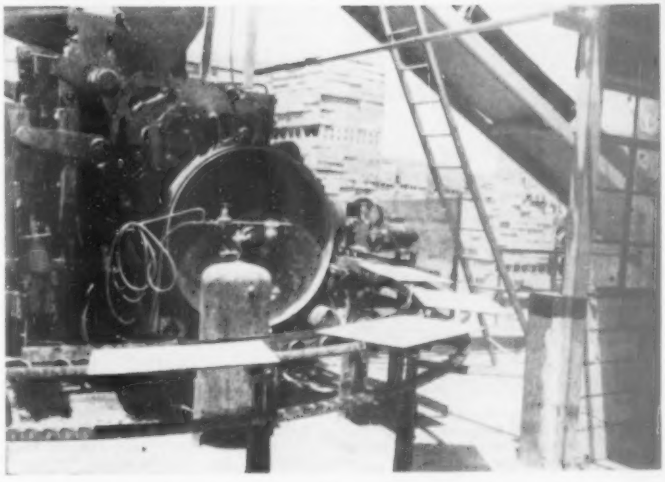
The operation, in essence, consists of batchers that feed a long traveling conveyor which carries the cement and aggregates to a short inclined belt serving the 50-cu. ft. Besser mixer that rests at ground elevation. The mixer unloads to a second inclined belt to the steel hopper over a Besser Vibrapac. This would be a very conventional set-up but for the fact that this one is entirely automatic. In the steel hopper over the Besser is a flop-gate that acts as a trigger. When the weight of the aggregate in this hopper gets to a certain low point, the trigger functions to start a small motor that serves a series of cams. These cams all function in the proper sequence, starting with the batching of the cement and aggregates, conveying to the mixer. Then mixing time is allowed for, after which the mixer dumps to the belt serving the block machine. The cycle is automatic and based on an 11-min. sequence. The device was company-built and is a neat and well-constructed piece of equipment.

The racks for the block are delivered to the block machine with the pallets in place. The operator of the block machine takes these off and dumps them into a receiving hopper in front of the block machine. The pallets then go under a rotary steel brush that cleans them. Next the pallets return to the back of the machine via a semi-circular conveyor. After dumping the pallets into the previously mentioned hopper, the operator picks up the loaded pallet and puts it on the rack. This automatic pallet return device was designed and built by the Superlite Corp. The operators have a Knickerbocker gaso-

(Continued on page 240)







RIGHT —
Top: Batching hoppers for cement and aggregate are located under silos. Center: Belt, foreground, receives weighed cement and measured pumice, delivering it to 50-cu. ft. mixer. Second inclined belt serves block machine. Bottom: Pallets are cleaned near front of block machine and are transferred to feed and via this semi-circular conveyor system

Three of the officers hold a conference. Left to right are, C. A. Persons, president; Herb Rusk, vice-president; and Claude Clark, secretary

Applications of lightweight aggregates to ready-mixed concrete discussed; tax legislation also considered

Ohio Ready-Mix Producers Meet

THE ONE DAY ANNUAL MEETING of the Ohio Ready Mixed Concrete Association, held at the Hotel Cleveland in Cleveland, June 15, brought together members of one of the most active state groups in the country to hear a series of reports on tax legislation, business conditions, and a panel discussion on lightweight concretes. Highlight of the meeting was an off-the-cuff talk on government developments by Vincent P. Ahearn, executive secretary of the National Ready Mixed Concrete Association.

Paul Hunt, retiring president of the association, opened the meeting with an explanation of the sales tax case initiated by Ralph Anderson of Columbus, Ohio. Some progress is being made in having a truck mixer designated a piece of manufacturing equipment and thereby eliminating sales tax. A special assessment of all members on the basis of truck units operated has provided funds for the fight, on which a decision is expected by the courts within the year. In the interim, it was suggested by Claude Clark, association secretary, that sales taxes on new equipment be paid under protest; this may make it easier to process legally in the event of future claims for tax rebate.

Mr. Hunt next reported the status of the truck driver's instruction manual. At the meeting of the Ohio group in conjunction with the National association in Chicago in January, a committee was appointed to investigate the possibility of preparing such a manual. However, when it was learned that much work on a manual has been accomplished by the N. R. M. C. A., all data collected were turned over to that body for incorporation in one complete booklet.

Stephan Stepanian, treasurer of the Ohio association, though unable to attend the meeting, had suggested that Ohio's ready-mixed concrete producers follow the example of the California Ready Mixed Concrete Association. That group made a contribution to the National association for operation of the new laboratories in Maryland. It was voted that Ohio members contribute $5 per unit for the laboratory, with the understanding that the N.R.M.C.A. would also apply this amount toward dues.

In the secretary's report, Claude Clark mentioned the meetings he has attended. Also included in his report were developments since the last meeting in January. Bond issues on projects approved in the state amounted to $18,000,000 from January through May, he stated. Revenue from the gas tax has increased 5 percent over 1949. There is some talk of an increased gas tax, Mr. Clark said.

Safety

In regard to safety and industrial insurance, Mr. Clark said that the workmen's compensation manual now contains a separate classification (8205) for ready-mixed concrete workers. The rate is 74 cents per $100 of payroll. As an example of the strides one producer is making in safety, Mr. Clark cited the W. E. Anderson Sons Co., Columbus, Ohio, which recently won an award from the Columbus Junior Chamber of Commerce. An award was also presented to the company as the safest in the state. The firm has 22 drivers with one-year accident free records, and 12 with two year accident free records.

Panel Discussion

Four manufactured lightweight aggregates for ready-mixed concrete were discussed by four representatives of producers. These were Aglite, discussed by R. Neal Christy, Marietta Concrete Corp., Marietta, Ohio; perlite, discussed by Wharton Clay, secretary, Perlite Institute, New York, N. Y.; vermiculite, covered by R. F. Rea, Zonolite Co., Chicago, Ill.; and haydite, discussed by Walter R. Schaefer, sales engineer, Geo. Rackle & Sons Co., Cleveland, Ohio. R. P. Mumford, Beckley & Myers Co.,

A between sessions respite is taken by H. C. Fidler, Zonolite Co., Cuyahoga Falls, Ohio, (left) and F. B. Fairchild, Cambridge Lumber & Coal Co., Cambridge, Ohio

V. P. Ahearn, executive secretary of N. R. M. C. A., addressing the luncheon meeting of the association

Springfield, Ohio, who acted as moderator of the panel, opened the period with a few remarks about the history of lightweight aggregates.

Vermiculite

R. F. Rea explained the sources and composition of vermiculite for the benefit of those who were unfamiliar with the material. Applications are principally for floors and roofs, he said. Vermiculite concrete is very important if radiant heating is used, for insulation is needed under the pipes. Mr. Rea listed four advantages of vermiculite concrete: (1) light weight, (2) insulation value (k = 0.6-1.6), (3) fire resistivity, and (4) sound absorption.

There are few particular problems presented in using vermiculite for ready-mixed concrete, Mr. Rea stated. However, the aggregate can be broken down by overmixing. Also, it is necessay to get all the water in the mixer at one time (otherwise the stiff mix will break down the aggregate). The procedure oftentimes followed, Mr. Rea said, is to stop the mixer upon leaving the batching plant, then start it going shortly before pouring on the job.

Perlite

The perlite industry is expanding rapidly, Wharton Clay stated. A new expansion plant is going up in Florida, and two new ones recently began production in Ohio. The applications of lightweight aggregates are claiming more attention from concrete producers, he added. The present field for perlite is for plaster first, and secondly for concrete. The aggregate is not recommended by itself for load-bearing use but for light weight (20 lb. per cu. ft.). There is no standard for sieve analysis of concrete aggregate yet, but it is being developed, Mr. Clay said. Some producers, he related, feel that the sieve analysis for plaster is suitable for concrete. Perlite can easily be used for ready-mixed concrete, Mr. Clay feels, and batching from bags may be the only problem encountered by operators.

The use of perlite with sand or other aggregate increases strengths. Concrete increases in compressive strengths as the density is increased.

Left to right: S. W. Wenban, Standard Portland Cement Div., Cleveland; N. R. Whitson, Mathias-Whitson Ready Mixed Concrete Co., Orrville, and A. E. Harpold, Bessemer Limestone and Cement Co., Youngstown

Haydite

This is one of the oldest lightweight aggregates on the market, Mr. Schaefer claimed. It is manufactured from selected clays and shales, which are burned at about 2250 deg. F. in a rotary kiln 50 ft. long. The temperature of 2250 deg. F. is the point of incipient fusion. The clay leaves the kiln with a ceramic coating and thousands of tiny holes in it. The material is dropped to stockpiles and allowed to cure for 2-3 months.

Concrete made from 1:3 to 1:5 mixes weighs about 100 lb. per cu. ft. A 1:6 mix gives a 73 lb. concrete. This aggregate too is suitable for ready-mixed concrete, and no special problems are involved.

Tilt-Up Construction

Mr. Mumford was asked to tell about the tilt-up method of construction his firm recently finished pouring. These were walls poured flat, made with crushed stone concrete and a 1 in. perlite insulation concrete coat on the inside. The cured sections were then raised into position, corner forms fixed, and the corners poured. The problem of getting good bond between the two layers of concrete was solved by using masonite panels with form oil between forms. Type I cement and Darex air-entraining agent were used. For the perlite concrete, 5½ oz. of Darex were used per bag. This gave about 18 percent air. A 7-bag mix was made.

The method used in mixing this job was as follows: the cement and perlite were dry batched in the mixer, then water and Darex were added and mixed for a short time. The mixer was then turned off until the job was reached, when it was turned on only long enough to discharge the batch. There was no yield loss as far as could be determined, Mr. Mumford said.

Aglite

Mr. Christy stated that the unsuitability of clay in the Marietta area for rotary kiln sintering led to the investigation of the Aglite process. It was found that the ordinary red clay would make an acceptable aggregate by this process. The clay is mixed with 10 percent fuel (coke breeze) and burned on a continuous grate machine (see ROCK PRODUCTS, November, 1949, p. 105). The mixture is ignited from the top by a burner, then burned and crushed. Three sizes are made: minus ⅛-in., plus ⅛-in. minus ⅜-in., and plus ⅜-in.

The plant of Marietta Concrete Corp. is presently turning out 175 cu. yd. Aglite per day with one shift. It is planned to put in two shifts in a short time. Trial batches of ready-mixed concrete made with Aglite give good results, according to Mr. Christy. It is best to add water to the aggregate first, then add the cement. Concrete

(Continued on page 240)

Talking over lightweight aggregates are, left to right, R. Neal Christy, Marietta Concrete Corp., Clayton Fink, Howard G. Wiley Co.; R. F. Rea, Zonolite Co., and Russell Mumford, Beckley & Myers Co.

Efflorescence Control

(Continued from page 233)

concrete. Excessive troweling will also carry the water to the surface, thereby increasing efflorescence.

Efflorescence can be reduced by following as much as possible the following procedure within the practical limitations of the product in the way of cost and versatility of machinery and process.

1. Use ingredients, cement, sand, water and pigment with least possible soluble salts. Of these four, the cement and sand are most important. Aggregate, either coarse or fine, which has been water washed, will contain fewer soluble salts. Aggregates such as crushed, washed and screened limestone or crushed blast furnace slag are usually relatively low in water soluble content. The cement used can be selected, by analysis, to contain the least amount of water soluble material. Pigments used should be specifically designed for use in concrete products by their rigidly controlled water soluble content.

2. Use such chemicals as active barium carbonate to react with the sulfate in all ingredients forming the insoluble and harmless barium sulfate.

3. Increase speed of cure as much as practical within strength limitations by use of the greatest possible drying air at lowest humidity. If the product is steam cured, it should be air dried prior to steam cure.

4. Use minimum amount of water.

5. Keep surface troweling to a minimum.

6. Use hardening agents to allow greater pigment loading without loss of strength.

7. Use waterproofing agents or waterproof cement to intensify color and to prevent return of water after cure is complete.

This was based on a talk given by C. W. Moore, Mineral Pigments Corp., before the Brikcrete Manufacturers of Western Pennsylvania in May.

Building Research Congress to be Held in London

A CONGRESS ON BUILDING RESEARCH, the first of its kind, will be held in London, England, September 11-20, 1951, during the Festival of Britain. The congress program will review the progress made in research in relation to architecture, building and associated branches of civil engineering.

The congress is sponsored by the British professional institutions, technical societies and governmental departments, with the support of representative industrial federations in Great Britain.

Papers are being invited from research workers in many countries on a wide range of topics, including prefabrication, concrete design, soil mechanics, and the design of foundations, weathering and durability of building materials, lightweight concrete, quality control and accelerated curing of concrete and many other topics.

Automatic Block Plant

(Continued from page 235)

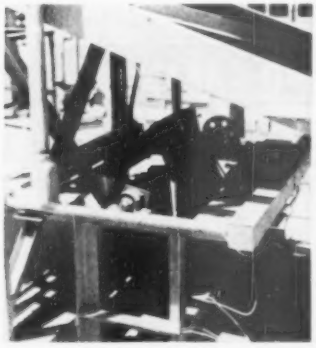
line-powered (Wisconsin air-cooled) and Hyster "40" lift trucks. Trucks are loaded with the latter lift truck. Four men are employed.

For curing there are four kilns open at the end nearest the Besser, supplied steam by a Campion-Detroit semi-automatic, gas-fired steam plant. It is one of the first to be used in the area south of Los Angeles and in the Southwest generally. In this type of equipment, controlled steam can be maintained at preset temperatures and a humid atmosphere is maintained by circulatory fans. After curing under humid conditions, dry air can be circulated to dry the masonry units thoroughly. It is the practice here to steam for 12 hr. at 160-180 deg. F. and dry for two hr., after which block are stored in the yard for additional air curing.

The pumice secured from the company's affiliate is a relatively hard material which is crushed and screened at the plant near the deposit. The pumice is of the type that will float in water for an indefinite period. Several samples taken at the deposit floated for over 48 hr. when subjected to a test. Block made from this type of pumice are said to have very low absorption. Mel Hustad is manager of the Calipatria operations.

The parent company, Builders Supply Corp. of Phoenix, Ariz., has just placed orders for four more Besser Super Vibrapac block machines. Two of these machines will be installed at the Phoenix plant to enlarge the operations there; one additional block machine will be installed at the Calipatria plant, and the new plant at Albuquerque will be doubled in size before it even gets into operation. All machines will operate on a 3-shift, 24-hr. basis.

This additional equipment now brings Builders Supply Corp. inventory to nine Besser Super Vibrapacs operating 24 hr. a day with a daily combined capacity of 150,000 block, or enough block to build 100 houses a day.



Cams are arranged in sequence and control automatic features of pumice block plant

Ready-Mix Meeting

(Continued from page 237)

made with Aglite weighs 103 lb. per cu. ft., and Aglite masonry units test 1500-1600 p.s.i. on the gross area. There is increasing demand for Aglite concrete for roof fills, Mr. Christy said.

Washington Developments

V. P. Ahearn was the speaker at the luncheon. He opened his talk by remarking that the truck driver's manual is in the process of being written. He then shifted to the Washington scene. According to many observers, Mr. Ahearn said that by far Sen. Taft of Ohio is the most able man in Congress. All industry, including the ready-mixed concrete industry, owes a lot to him because of the Taft-Hartley Law, which prohibits many labor abuses. He pointed to Chicago as an example of an effective labor boycott (now illegal), where ready-mixed concrete was kept out of the area until last year.

The Hoover Commission report and the federal budget deficit next claimed Mr. Ahearn's attention. The Administration has seized upon the Hoover recommendations to attempt to eliminate the general counsel in the National Labor Relations Board, something that was far afield of the original recommendation, he stated. As for the deficit, it can only increase, Mr. Ahearn fears. Public compensation and social security laws will most likely increase, thus raising the deficit.

The United States is committed to helping Europe for many, many years, in Mr. Ahearn's opinion. This may cause shortages in this country which could bring a return of material allocations. He also predicted an increase in personal income and corporation taxes next year. Nevertheless, Mr. Ahearn stated that too many industries want special favors and considerations. One of the most disturbing factors in Washington, said Mr. Ahearn, is the movement by some business for legislation to provide machinery for compulsory arbitration of labor disputes. That will absolutely not work. It would lead to price control, allocation, and government de-

cree of business, and would mean the end of our free competitive enterprise, he concluded.

Mr. Ahearn answered a question from the floor concerning Sen. McCarthy's accusations by saying that the senator is making considerable headway. Domestic communism is still a threat. In fact, Mr. Ahearn said that he is more concerned about what happens in this country in regard to communism and government controls than he is about war with Russia.

Officers

The meeting concluded with election of officers. Officers for the next year are president, C. A. Persons, Elyria; vice-president, Herbert Rusk, Mansfield; treasurer, Stephan Stepanian, Columbus; and secretary, Claude Clark, Columbus. Directors elected are J. A. Radebaugh, Lancaster; Carl Shoaff, Akron; and L. A. Kemter, Cleveland. In addition, Charles Kuhlman, Toledo, was elected to serve the unexpired term of Ed Kuhlman of Toledo, who died recently.

Many members of the association arrived the evening before the formal session to attend the night baseball game between the Cleveland Indians and the Boston Red Sox. The home towners were gratified to see their team win.

•

MISSOURI BUILDERS' SUPPLY CO., Boonville, Mo., has been sold to Lawrence and Herb Schumaker by William Clinkscales. Mr. Clinkscales plans to establish a new ready-mixed concrete plant in Sweetwater, Tex.

INDUSTRIALS MATERIALS CO., Pasadena, Texas, has announced plans to construct a concrete batching plant at an estimated cost of $75,000.

MURPHY & MURPHY TRANSIT CONCRETE & CONSTRUCTION CO., Mineral Wells, Tex. has begun operations. The company is owned and operated by Claude Murphy and his son, Lloyd Alton Murphy.

TONY DUFEK has announced plans to operate a ready-mixed concrete plant near Antigo, Wis.

Agricultural Concrete Pipe Association Formed

AMERICAN CONCRETE AGRICULTURAL PIPE ASSOCIATION, Chicago, Ill., was recently formed when a group of men from the industry interested in concrete irrigation pipe and concrete drain tile met in The Hotel Utah, Salt Lake City. Formation of this group completes the organization of the entire concrete pipe industry along the lines discussed at the meeting in San Francisco in February.

Officers of the new association are Gilbert D. Williamson, Yuba City, Calif., president; J. W. Porter, Dallas, Tex., vice-president; George F. Lillie, Scottsbluff, Neb., secretary-treasurer, and Elmer L. Johnson, Colton, Calif., director at large. Details of the constitution and by-laws are being worked out by a committee functioning under President Williamson.

American Concrete Agricultural Pipe Association has affiliated with the American Concrete Pipe Association and the American Concrete Pressure Pipe Association. These three associations will coordinate activities as members of a joint coordinating and affiliating association known as "Concrete Pipe Associations, Inc." This organization will be under the direction of Howard F. Peckworth, who is managing director of all three organizations. Headquarters of this industry association are located at 228 North LaSalle Street in Chicago. The staff, in addition to Mr. Peckworth, consists of William A. Haley III, assistant to the managing director, John G. Henderickson, research engineer, and three secretaries.

Concrete Tile Shingles

BARTILE MANUFACTURING CO., Pocatello, Idaho, is producing a new type of roofing, a straight cement tile which comes in variations of white or two shades of red. The product is said to be meeting such a reception, a third plant is contemplated in addition to plants now in operation in Pocatello and Boise. Made of hydroplastic cement, glass sand and mineral oxide, the tile shingles weigh about 4 lb. and measure 9 x 15 in. They are put in place like wood shingles, through an interlocking feature. Present production is 2550 tile per day.

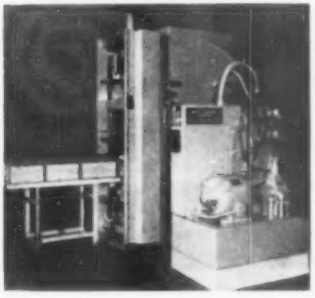
Observes First Anniversary

NEBRASKA CRIB AND SILO CO., Kearney, Neb., is observing its first anniversary with the completion of its manufacturing plant. The company can now produce all of the concrete block material needed for crib and soil construction, with only fabricated steel being made at the home plant at Fremont. The firm has a Jet-Crete machine for waterproofing building exteriors and for lining irrigation ditches to prevent seepage.

NEW MACHINERY

Hydraulic Block Machine

MULTIPLEX MACHINERY CORP., Elmore, Ohio, has announced its new Multico Block machine. The unit is hydraulically powered and fully automatic, and is reported to use any type of aggregate with equally good results. It tamps under pressure vibration producing, in one operation, all sizes and shapes of block which are uniform in size, weight and texture with flat smooth surfaces and sharp edges, the manufacturer states. Special height block can be produced by adjustment of the sizing columns. Steel pallets can be stacked in the machine by the operator. The machine is said to require no operator except an offbearer once controls are set, thus making it possible to operate an entire plant with only three men. A valve control, electrically or hydraulically powered, permits removal of block from machine to rack, four block at a time. It is available in Model 3 producing three block per cycle and Model 2 producing two.



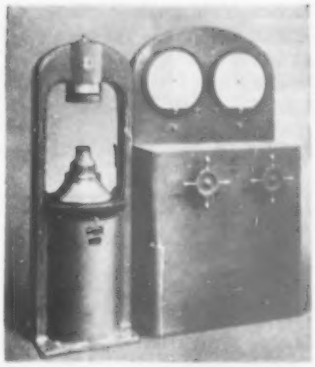
Hydraulic automatic block machine

Heavy-Duty Lift Trucks

SILENT HOIST & CRANE CO., Brooklyn, N. Y., has brought out a new series of heavy-duty Liftruks. These new units are available in three sizes, of 5-, 7½- and 10-ton capacities, the manufacturer states. Various standard attachments are available for the trucks, such as shovels, special forks, power spreaders, winches and crane booms.

Concrete Testing Machine

THE BALDWIN LOCOMOTIVE WORKS, Philadelphia, Penn., has introduced a new concrete testing machine of 300,000-lb. capacity. Principal feature of the new machine as compared with the previous design, according to the manufacturer, is that loading and weighing units are separate. This prevents the transmission of load shocks to the indicators. The two-unit design also permits varying their relative positions to suit conditions of use and protects the operator from flying or falling particles of breaking specimens.



Two-unit testing machine for concrete specimens prevents transmission of load shocks to indicators; load ranges are 0-50,000 lb. and 0-300,000 lb.

The new testing machine is a hydraulic compression-type especially suitable for standard concrete cylindrical test specimens 3 x 4 in., 6 x 12 in., and 8 x 16 in. Special bearing blocks are available for testing masonry units 12 in. wide and 18 in. long.

The loading unit has a clear space of 18½ in. between columns and a maximum clear space of 26-5/16 in. between ram and upper platen. The loading unit occupies a floor area of 18 x 22½ in.; the indicator and control cabinet occupies 18 x 42 in.

CLASSIFIED ADVERTISEMENTS

SAVE 50%

We guarantee savings of ½ and more on all used equipment.

1—No. 9 JOLTCRETE	$3500.00	2—Multiplex Chimney Block Machines and Pallets, ea.	$ 150.00
1—No. 7 JOLTCRETE	1500.00	2—Pallet Dunkers, ea.	55.00
40—STEEL RACKS, ea.	15.00	2—Anchor Tampers, ea.	150.00
1—Stearns 18 Cubic Ft. Mixer	400.00	2—Stearns Clipper Stripper, ea.	750.00

GENERAL ENGINES CO., INC.
307 Hunter St. Gloucester, N. J.
WRITE, WIRE, PH.: Gloucester 6-1337

Thousands of Steel and Aluminum Pallets in stock, all sizes. Send tracing for quotation.

FOR SALE

1 Stearns "A" Clipper Stripper, newly repaired complete; pallets, racks, oiler, 18 ft. mixer and skip loader.
1 Barrett lift truck in good condition.
1 Reed chimney block machine almost new, with pallets.
1 Jaeger 6 S one-bag mixer, almost new.
1 Erie 68 yd., 3 compt. bin with double clam shell gates, NEW, NEVER USED. With 1 yd. batching bin.
1 Eagle 45 ft. bucket elevator, complete, NEW, NEVER USED.

MASONRY PRODUCTS CO.
Columbia City, Indiana

FOR SALE

No. 7 Joltcrete with 3,000 8" and 2,000 6" 3 oval-core pallets. 40 Steel racks, 62 capacity. Stearns 18 cu. ft. mixer and 5 hp Motor. Blystone 7 cu. ft. Mixer and 3 hp Motor. Multiplex chimney block machine with 100 pallets. Anchor automatic tamper machine for making stone face, panel block and regular block, including a large number of wooden pallets for same. Ruger 3 cu. ft. mixer for mixing facing material. Roller-type pallet oiler. 2 Hand Trucks for handling bagged cement. Lift truck (manually operated) for transporting racks. (Can be seen in operation.)

LYCOMING BLOCK
801 Beeber St. Williamsport, Pa.

FOR SALE

One 4½ yd. Jaeger Hi-Dump mixer less than a year old.
One 5 yd. Jaeger Horizontal mixer.
One Erickson Fork-Lift Truck, 2 years old.
One 32 foot tandem flat-rack trailer.

HUTSONVILLE CONCRETE COMPANY
Hutsonville, Illinois — Phone 20

FOR SALE

Korpak Block Machine with 8" and 4" mold box attachments. Good condition. Purchased new 1948. Price $850.00.

WHEATLEY CONCRETE PRODUCTS CO.
Waverly, Ky.

TRUCK MIXER FOR SALE

For sale, one new Concrete Transport Mixer mounted on new Ford truck. Will sell at discount.

W. M. HAITH TANK WORKS
205 Market St. Beatrice, Nebr.

One (1) 2 yard Transport Transit Mixer Price $1,000
One (1) 1½ yard Rex Transit Mixer Price ..... $ 500
500 only, ¼x18x18 steel pallets, Price ..... $ 450
All in good condition

CONCRETE PRODUCTS CO.
Wakefield, Mich. Phone 6611

PACKER-HEAD WINGS

Both McCracken Type and Martin Trowelers—PROVED to last as long or longer — yet cost considerably less. Write for prices.

TEXAS FOUNDRIES
LUFKIN, TEXAS

FOR SALE

1—Used Davey Compressor Model 105-D Like New. Electrified On Rubber. $1750.00 F.O.B. Rockford, Illinois

SCANDROLI CONSTRUCTION CO.
823 N. Madison St. Rockford, Ill.

FOR SALE

Concrete Block business; manufacturing Mortar & Mortarless blocks. & Material supply business, selling Flagstone, Bricks, Patio Blocks, Barbecue Supplies, & Fireplace Equipment. Plus Living quarters with office, & display yard, in the best location in town. Rent reasonable.

RIVERSIDE INTERLOCKING BLOCK CO.
6450 Magnolia Ave. Riverside, Calif.

FOR SALE

One Yale & Towne stroke jack to handle 60 or 72 block rack. Good as new. Price $200.00

Solat Concrete Block Co.
Tiltonsville, Ohio

FOR SALE

DUNBRIK BRICK MACHINE, as is or reconditioned. Pallets, racks, mixer and hoist also available. Write Box I-83, Rock Products, 309 W. Jackson Blvd., Chicago 6, Ill.

FOR SALE

Going four unit transit mix concrete business in small midwestern industrial city. Box I-79, Concrete Products, 309 W. Jackson Blvd., Chicago 6, Ill.

Car unloader and truck loader—combination—electric—mounted on rubber good condition, also 2 oil pressure salamanders good condition.

C. R. BEVAN
Kokomo Cement Prod. Co., Inc.
Kokomo, Ind.

FOR SALE

Three cubic yard I. & W Transport Mixer, original cost $2,958.00. Entirely rebuilt exactly like new, and used only thirty days since. Bargain at $1,500.00.

McCOY'S READY MIX CONCRETE CO.
530 Marshall St. El Cajon, Calif.

FOR SALE

Block plant, bldg mat'l and contracting. 4000 sq. ft. plant space. 10 room residence all on 19 acres. $30,000 sales Jan. to July. Reason, health. Price about $50,000. Write or phone 60104 E. I. Koons

PRECAST CONCRETE CO.
Ashland, Ohio

UNBREAKABLE PALLET RINGS

Write for full information

TEXAS FOUNDRIES
LUFKIN, TEXAS

FOR SALE

Besser K-3 Semi Automatic, motor, V belt drive, App. 1500 pallets, $200.00 new parts, mch. overhauled $600.00, 50 steel racks 18.00 ea. or all for $900.00.
One 3 H.P. Gear head motor for skip hoist like new $200.00. 45 yd. 2 comp. steel bin 500.00. New 3 H.P. Pedestal grinder 2—12" grinding, 1—12" wire wheel 175.00.

STRONG BLOCK CO., LaCrosse, Wis.

FOR SALE

For sale, patent pending on new simple interlocking building block used with or without mortar. Do not inquire unless interested. Direct replies to Box I-82, Rock Products, 309 West Jackson Blvd., Chicago 6, Ill.

FOR SALE

1 or 2 Model 2-C Dumpcrete bodies built up for 3 yard capacity. Used one year. Will consider selling complete units mounted on 1949 Reo trucks. Reasonable.

SCANDROLI CONSTRUCTION CO.
823 N. Madison St. Rockford, Ill.

FOR SALE

Pallets, 2" (3 core), 2¼" (3 core, new 1947), 2¾" (3 core, old), 3¼" (3 core plus center, none new 1947), 7⅝" (2 core, new 1947), 8" (3 cores) for 15⅝" length. Also No. 9 Joltcrete mold boxes for above; parts enough to rebuild several No. 9 Joltcretes; New Bullard Hammermill, plus patterns for replacement, including rolls.

PRE-SHRUNK MASONRY SALES CORP.
P.O. Box 838 Roanoke 4, Virginia

FOR SALE

Besser K-3 Tamper with Vibrating Mold Box Complete with attachments. At a give away price—overhauled and ready to go.

DINABURG BLOCK CO.
P. O. Box 662 Binghamton, N. Y.

WHY NOT INSTALL an ASBESTOS-CEMENT PIPE or SHEET-MAKING PLANT? Complete plants for making PRESSURE PIPES and CORRUGATED SHEETS. Speedy deliveries. Plants designed, equipped and started. Our Engineers have thirty years experience in making Asbestos-Cement Pipes and Sheets.

STOCK'S ENGINEERING COMPANY S.a R.L.
già Durito Tecnica
24, Via di Cavana Trieste, (Italy)
Cable Address: STOCKSDURITE-Trieste

CEMENT COLORS

Write for free samples and prices of "LANSCO" CEMENT COLORS produced in 34 attractive shades. Packed in bulk and in 1 lb. and 5 lb. packages.

manufactured by
LANDERS-SEGAL COLOR CO.
73 Delevan St. Brooklyn 31, N. Y.

ALSO SEE CLASSIFIED ADVERTISING ON OTHER EQUIPMENT IN ROCK PRODUCTS' GENERAL SECTION

FOR SALE

FOR SALE OR LEASE

Dunbrik machine complete—hoist, mixer, motors, Dunstone double and triple brick attachment. 26 Dunbrik steel trucks, each holds 720 brick. 6240 steel pallets. Industrial mat glazing machine. 8" Kissam-Blatt block machine complete mixer, conveyor, hopper and 3 way chute. 24 Block Racks—1200 Pallets. Lift truck, 2 ton electric hoist, 400 Amp. welding machine other equipment and tools. All in excellent condition—for sale at sacrifice. Plant located in Paterson, N. J. for sale or lease at low rental with purchase of machinery. Box I-85, Rock Products, 309 W. Jackson Blvd., Chicago 6, Illinois.

FOR SALE

Crushed and sized cinder aggregate, tested and approved for the manufacture of cinder blocks. Write:

DULUTH CINDER, SLAG & STONE CO.
Box 116 Duluth 7, Minn.

BLOCK PLANT FOR SALE

Complete block plant with lot buildings and truck.

To be sold as one unit.

Peru Cement Products
228 E. Spring St. Peru, Indiana

Established, good paying Ready Mixed Concrete and allied building materials business. Operating four new mixer trucks steady. Existing house and industrial contracts go with business.

Located in Central Illinois, serving a fast expanding industrial area and a rich farm and active city trade. Box I-86 Rock Products, 309 W. Jackson Blvd., Chicago 6, Illinois.

CONCRETE BRICK COLORS
CEMENT COLORS
MORTAR COLORS

made by
BLUE RIDGE TALC CO., INC.
Henry, Virginia

EQUIPMENT WANTED

WANTED

A 4000 lb. capacity gasoline powered fork lift truck, pneumatic tires only. Towmotor with side shift preferred but other makes will be considered. Send full particulars and price.

THERRIEN BROTHERS
Box 20 East Freetown, Mass.

EQUIPMENT WANTED

We will purchase for cash two old style Vibrapacs—model using 18½" x26" pallets. Operating condition not necessary. Wire your offer.

Bethayres Concrete Products Co.
Bethayres, Pa.

WANTED

250 Ft. of 42" or 48" wide, good used rubber conveyor belting. State specifications, condition, type of service, location and price.

H. T. HAGEN
Zenith Dredge Co.
Duluth, Minnesota

POSITIONS VACANT

SALES REPRESENTATIVES

Wanted, acquainted with concrete products manufacturers and building materials dealers, to sell national brand cement colors in bulk and packages on commission basis. Several active territories open. Box I-74, Concrete Products, 309 W. Jackson Blvd., Chicago 6, Illinois.

FOR BEST RESULTS IN SELLING USED EQUIPMENT, USE THE CLASSIFIED SECTION OF CONCRETE PRODUCTS.

FREE SERVICE *for BUYERS*

Here is the quick way to get information and prices on machinery and equipment. Just check the item (or items) listed below about which you desire information. Then send this page to us, and we will take care of the rest.

TEAR OFF HERE

- Admixtures, Aggregate
- Aftercoolers, Air
- Aggregates (special)
- Air Compressors
- Air Separators
- Asphalt Mixing Plants
- Bagging Machines
- Bags
- Barges
- Batchers
- Belting, Conveyor, Elevator, Power Transmission
- Belting, V-Type
- Belt Repair Equipment
- Bin Level Indicators
- Bins and Batching Equipment
- Blasting Supplies
- Block Machines Concrete Building
- Bodies, Trailer
- Brick Machines and Molds
- Buckets
- Bulldozers
- Cars, Industrial
- Classifiers
- Clutches
- Coal Pulverizing Equipment
- Concentrating Tables
- Concrete Mixers
- Concrete Mixing Plants
- Concrete Specialty Molds
- Concrete Waterproofing and Dampproofing
- Conveyors
- Crushers
- Coolers
- Cranes
- Derricks
- Dewatering Equipment, Sand
- Diesel Engines
- Dragline Cableway Excavators
- Draglines
- Dredge Pumps
- Drilling Accessories
- Drills
- Dryers
- Dust Collecting Equipment & Supplies
- Electric Motors
- Engineering Service, Consulting and Designing
- Explosives & Dynamite
- Fans and Blowers
- Flotation Equipment
- Gasoline Engines
- Gear Reducers
- Generator Sets
- Grinding Media
- Gypsum Plant Machinery
- Hard Surfacing Materials
- Hoists
- Hoppers
- Kilns: Rotary, Shaft, Vertical
- Locomotives
- Lubricants
- Mills
- Pulverizers
- Pumps
- Scales
- Screen Cloth
- Screens
- Scrubbers: Crushed Stone, Gravel
- Shovels, Power
- Speed Reducers
- Tanks, Storage
- Tractors
- Trucks, Industrial
- Trucks, Mixer Body
- Trucks, Motor
- Vibrators
- Welding & Cutting Equipment
- Winches
- Wire Rope

If equipment you are in market for is not listed above, write it in the space below.

_____

_____

_____

Send to:

Research Service Department
ROCK PRODUCTS
309 W. Jackson Blvd. • Chicago 6, Illinois

Your Name _____ Title _____

Firm Name _____

Street _____

City _____ State _____

CP-8

INDEX TO ADVERTISERS IN THE CONCRETE PRODUCTS SECTION OF ROCK PRODUCTS

ALSO SEE INDEX OF ROCK PRODUCTS SECTION ADVERTISERS ON PAGES 264, 265

AT LAST!

chem brick

A FACE BRICK OF HIGHEST QUALITY—

MADE WITH THE CHEAPEST MATERIALS KNOWN TO DATE

"CHEM BRICK" requires no cement or commercial lime . . . is made only with sand and waste materials.

Detroit Brick & Block Company, first licensee by Jackson & Church Company to manufacture "CHEM BRICK"

"CHEM BRICK" . . .

the sensational, new building material . . . passes the A.S.T.M. specifications for first quality face brick and the most exacting freezing and thawing tests . . . yet no ingredient costs more than $2 per ton, including binder.

PITTSBURGH TESTING LABORATORY

REPORT
TESTS OF "CHEM" BRICK
MANUFACTURED BY
DETROIT BRICK & BLOCK CO.

COMPRESSION
(4 Brick Crushed Flatwise)

NO. OF SAMPLES	LBS. PER SQ. INCH
5	Average 4,910

MODULUS OF RUPTURE

NO. OF SAMPLES	TOT. LOAD LBS ON SP.
5	Average 975

ABSORPTION
(24 Hour Immersion - 4 Brick)

NO. OF SAMPLES	PERCENT ABSORPTION
5	Average 1.16

All samples submitted by Detroit Brick & Block Co.

PITTSBURGH TESTING LABORATORY
By W. Stevenson Jr.
MANAGER DETROIT DISTRICT

April 8, 1949

REPORT - FREEZING & THAWING

METHOD OF TEST - A.S.T.M. Designation: C67-44 covering Standard Methods of Sampling & Testing Brick for a total of 51 cycles.

CONCLUSIONS - Test indicated compliance with specification requirements for freezing and thawing test.

Respectfully submitted,
PITTSBURGH TESTING LABORATORY
Frank Lea
Frank Lea
Cement & Concrete Section

A REAL HIGH QUALITY FACE BRICK WHICH CAN BE MADE CHEAPER THAN ANY COMMON BRICK ON THE MARKET TODAY

This quality product . . . made by the cheapest process in the brick industry is finding a ready market in the Detroit area where it has brought usually expensive brick veneering within the reach of average purses. In addition to its low cost other features are its distinctive finish, color and uniformity which give any building that "quality appearance" when used as a facing material.

Besides being a fine face brick . . . "CHEM BRICK" is an all-purpose brick because of its low cost of manufacturing. Can be used anywhere brick is used . . . facing, back-ups, partitions, manholes, fire places, chimneys, basement walls, etc.

Boxed at left are excerpts from test reports on "CHEM BRICK" made by Pittsburgh Testing Laboratory. Note distinctive appearance of home pictured utilizing "CHEM BRICK" as facing material.

Typical new home construction using "CHEM BRICK" as face brick. Detroit, Michigan.

JACKSON & CHURCH COMPANY
SAGINAW, MICHIGAN
"WORK WELL DONE SINCE '01"

Complete

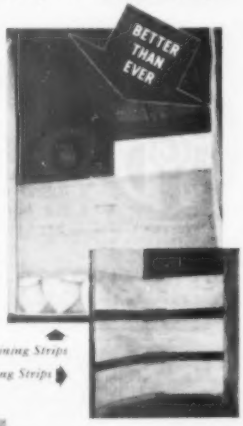
DOORWAY PROTECTION FOR CARLOAD SHIPMENTS

FOR BAGGED PRODUCTS

SIGNODE RETAINING STRIPS

nailed across freight car doorways—either spaced or overlapped—hold load firmly in position, prevent side shifting. Low cost . . . easy to unload . . . they reduce dunnage weight, eliminate car door liners.

Made of heavy kraft paper and reinforced top and bottom with strong steel strapping. Signode Retaining Strips are available in two types: *Regular*—for use on non-loading doorway; and *Duplex*, with the "walk in" feature—an entirely new development for loading doorway—specially designed to be severed in the center and then resealed.



Signode Retaining Strips

Signode Duplex Retaining Strips

FOR BULK MATERIALS

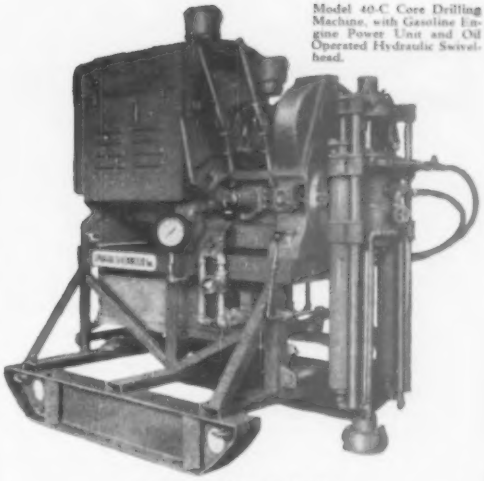
SIGNODE RETAINING DOORS

have proved to be ideal doorway barricades for such products as commercial fertilizers, silica sand, clay and other minerals shipped in bulk. Made of strong steel strapping scientifically spaced between layers of heavy duty, water repellent kraft liner board. Protection against seepage is positive because pressure of load seals sides and bottom flap. One-piece construction. No need for doorway liners. Light, easily applied and removed. Low cost. *For complete information write . . .*

SIGNODE STEEL STRAPPING COMPANY

2662 North Western Avenue. • Chicago 47, Illinois

THIS SEAL MEANS SIGNODE SECURITY IN SHIPPING



Model 40-C Core Drilling Machine, with Gasoline Engine Power Unit and Oil Operated Hydraulic Swivelhead.

60 YEARS

of Successful Experience in

DIAMOND CORE DRILLING

enables us to manufacture drilling machines that can be relied upon for long periods of continuous high-speed operation, with greatest possible percentage of core recovery. Modern designs, rugged construction, and liberal use of alloy-steel parts minimize time losses and operating expense.

Swivelheads can be either "Screwfeed" or "Hydraulic." Power-unit can be either a gasoline or Diesel engine, an air engine or an electric motor—each driving the swivelhead and hoisting drum through a built-in four-speed sliding-gear transmission. A complete line of improved accessory equipment provides for every drilling and sampling requirement. Catalog mailed promptly on request.

CONTRACT DRILLING

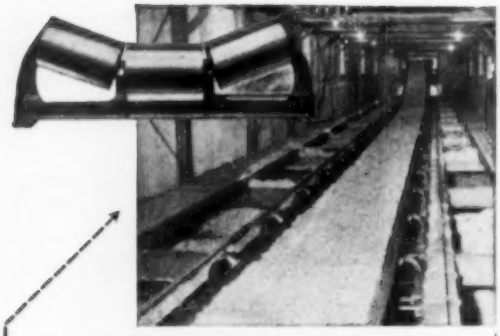
Besides being manufacturers, we are also one of the largest contractors for any type of Core Drilling—including Grout Holes and Grouting. Experienced crews and supervisors are available at all times for service anywhere in the world. Estimates, and constructive suggestions whenever possible, submitted promptly without charge or obligation.

"TRUCAST" BORTZ DIAMOND BITS

have proved their superiority for years in all types of rock formation. Bits may be furnished with various grades of bortz diamonds, set in a matrix of either Beryllium Copper or Beryllium Nickel alloys. Available in a wide range of standard and special sizes ranging from 1½" to 7¾" in diameter.

SPRAGUE & HENWOOD, Inc.

Dept. R. SCRANTON 2, PENNA.



For Lower Handling Costs Use LINK-BELT "100" Belt Conveyor Idlers

Link-Belt "100" series belt conveyor idlers offer outstanding service features for better wood chip handling. GREASE-IN-DIRT-OUT SEAL prevents harmful matter from reaching bearings . . . ROLLS with smooth rounded-edge outer shell minimize belt wear . . . HIGH-GRADE ROLLER BEARINGS . . . INTERLOCKING NUTS AND YOKES prevent brackets from spreading under unusual impact . . . END BRACKETS of tough malleable iron in reinforced T-section withstand heavy loads . . . GREASE FITTINGS for rolls, protected within end bracket, provide easy, safe lubrication.

Complete Link-Belt Line Includes: Return Idlers • Rubber Tread Return Idlers • Rubber-Tread Impact Troughing Idlers • Positive Action Self-Aligning Idlers

LINK-BELT COMPANY Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices, Factory Branch Stores and Distributors in Principal Cities. 11,625 A

HETHERINGTON & BERNER

DREDGING PUMPS

performance-proven on the toughest jobs

Hetherington & Berner sand and gravel pumps are available in two general types: *STANDARD*, (4", 6" and 8" sizes) with semi-steel parts, for ordinary working conditions and moderate heads; and *DREADNAUGHT*, (6", 8", 10", 12" and 15" sizes) with manganese steel parts, for heavy duty jobs with stringent head conditions.

Write for Bulletin DP-147.

HETHERINGTON & BERNER INC.

717 Kentucky Ave. Indianapolis 7, Indiana

GAYCO CENTRIFUGAL SEPARATORS

GAYCO Separators, equipped with the adjustable centrifugal sizing fan — an exclusive GAYCO feature — make closer separations. Closer separations bring about higher production through efficient removal of the fines made by the mill. Closer separations bring about higher quality products by eliminating all undesirable oversize.

"TIMKEN BEARING EQUIPPED"

GAYCO brings you all these:

Range 60 to 400 mesh

Greater capacity

25 to 30% greater production

Cleaner Tailings

Uniform Products

Slow speed for slow wear

Quick and easy adjustments

If you have an exceptionally hard separating problem, TRY THE GAYCO.

UNIVERSAL ROAD MACHINERY CO.

Robert M. Gay-Division

Factory and Laboratory, Kingston, N. Y.

117 LIBERTY STREET NEW YORK 6, N. Y.

Canadian Representative: F. H. Hopkins & Co., Ltd. 8500 Decarie Blvd., Montreal, Que.

PERFORATED METAL SAND AND GRAVEL SCREENS

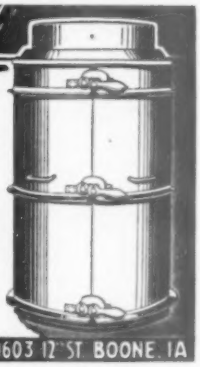
Manufactured exactly to your specifications

Any size or style screen, in thickness of steel wanted with any size perforation desired.

We can promptly duplicate your present screens at lowest prices

CHICAGO PERFORATING CO.
2437 West 24th Place
CHICAGO 8, ILLINOIS
Virginia 7-6787

THE Quinn Standard FOR CONCRETE PIPE



The Quinn Standard is known as the best the world over, wherever concrete pipe is produced and used. Backed by over 35 years service in the hands of hundreds of Quinn-educated contractors, municipal departments and pipe manufacturers who know from experience that Quinn pipe forms and Quinn mixing formulas combine to produce the finest concrete pipe at lowest cost.

QUINN HEAVY DUTY PIPE FORMS

For making pipe by hand methods by either the wet or semi-dry processes. Built to give more years of service—sizes for pipe from 10" up to 120" and larger—tongue and groove or bell end pipe at lowest cost.

WRITE TODAY. Complete information, prices, and suggestions sent on request.

Also manufacturers QUINN CONCRETE PIPE MACHINES

QUINN WIRE & IRON WORKS 1603 12 ST. BOONE, IA

CLASSIFIED ADVERTISEMENTS

FOR SALE

CONSULT US BEFORE BUYING OR SELLING USED FARREL-BACON CRUSHERS SIZES 60"x48" to 10"x7"

As manufacturers of these machines we are in a position to assure you as to condition and operating ability. Send for catalog.

149 Broadway **BACON-PIETSCH CO., INC.** New York 6, N. Y.

FOR SALE

N. W. Model 6—1¼ yd. N. W. Model 8—2 yd. Lima 1201—Cummins engine—3 cu. yd. Shovels—¾ yd. combination—others.
Four Super C Tournapulls—Euclid Trucks—locomotives—Dump cars—Cranes.
Rotary Kilns—Dryers—10'x90'—10'x170'—others.
250 KVA—440 volt—G.E. Diesel Generator Set—like new.
48" Gyrosphere Crusher—Gyratory Crushers—Roll Crushers, Cone Crushers—Jaw Crushers—60"x42"—25"x60" R.B.—24"x36"—20"x36"—18"x36"—15"x36"—10"x36"—Complete crushing plant including 42"x36" Jaw—Others.
Rod Mills—Ball Mills—Feeders—Classifiers—Tylers—Mine hoists—Motors—Transformers—Conveyors—Portable Gravel Plants—Blast Hole Drills.
5040 Dixie Mogul Hammer Mill—D-13000 Caterpillar Engine—Many other items.

STANLEY B. TROYER
Theatre Building Crosby, Minnesota

FOR SALE

1 used complete No. 6 style "K" Gates Crusher, Machine No. 5356

also

Repair parts for No. 6 Gates Crusher

QUARTZITE STONE CO., INC.
Lincoln, Kans. Phone 416

TOURNACRANE FOR SALE

30-ton Tournacrane, 35' Boom, with Super C Tournapull, diesel dr., 24.00 x32 tires, 24 ply. Almost new.

Especially suitable for heavy lifting and hauling on construction jobs, oil fields, lumber camps, quarries, etc. where caterpillar crane will not maneuver. Sacrifice.

Construction & Power Machinery, Inc.
270-23d St. Brooklyn 15, N. Y.
South 8-4900

RAILS—NEW AND RELAYING CARS—NEW AND USED—ALL TYPES

M. K. FRANK
480 Lexington Ave. Park Building
New York City Pittsburgh, Penna.
105 Lake St., Reno, Nevada

FOR SALE

Attractive price.
Allis-Chalmers No. 12 Style N Crusher Manganese steel concaves and head. With or without 125 H.P. Motor.

ANNA QUARRIES, INC.
Anna, Illinois

9 JAW CRUSHERS—18x36, 24x15, 24x36 and 42x48 FARREL—TRAYLOR
CEDAR RAPIDS—ALLIS-CHALMERS
3864 Ft. C. P. Electric Air Compressor
7'x16' Marcy Rod Mill
14' and 16' Gayco Separators
12 and 25 ton vulcan gas locomotives
25 ton Amer. gas loco. crane
30 ton Plymouth Diesel Locomotive
4 ft. and 5½ ft. Symons short head cones
4—I.R. Quarry Master Drills
2—6'x48" Hardinge ball mills
3100 ft. new 36" Conveyor Belt
4,000 ft. 60" and 48" conveyor belts.
80'x45' and 104'x85' rotary dryers
16 Vibrating Screens, 3x6, 3x8, 4x12, 5x12 and 5x14
29T Bucyrus well drill
1250 H.P. Nordberg and 500 H.P. Worthington 2300 V. Diesel generators

DARIEN, 60 E. 42nd St., N. Y. 17, N. Y.

FOR SALE

Attractive price.
Allis-Chalmers No. 12 Style N Crusher Manganese steel concaves and head. With or without 125 H.P. Motor.

ANNA QUARRIES, INC.
Anna, Illinois

FOR SALE

1—Hetherington & Berner Cyclone Dust Collector made for PE-30 Asphalt Plant, in perfect condition, handle approx. 18000 cu. ft. air per minute.
1—Cluster of four (4) high velocity cyclone dust collectors, made by Ducon Co., in good condition.

HIGHWAY MATERIALS, INC.
Bridgeport, Penna.

OVERHEAD TRAVELING CRANE

Milwaukee crane 80' span, bucket type 4 motors, 3/60/440 volts, two drums, high lift about 50'. New year 1929. Good Condition—Priced attractively.
Try us for other cranes too.

Allstates Equipment Co.
343 S. Dearborn St. Chicago 4, Ill.
Phone: Harrison 7-1821

FOR SALE

1—New Buda Gasoline Engine, Model HP260, Serial No. 284270—A standby never used.

Box I-55 ROCK PRODUCTS, 309 W. Jackson Blvd., Chicago 6, Illinois

LIMA DIESEL DRAGLINE

Diesel powered and equipped with 100 ft. boom and 3½ yd. Hendrix bucket. Although three years old, the machine has had little use and is in excellent condition. Location, Michigan

W. J. MEAGHER & SONS
24th & Water Sts. Bay City, Michigan
Phone 9811

New GENERATORS Surplus

Diesel, Gasoline, or motor driven
1 to 1000 kw.
Transformers — Motors — Switch Gear
Bought—Sold—Rented

MIDWEST UTILITIES POWER EQUIPT. CORP.
1272 W. Augusta Blvd. Chicago, Ill.
Phone, Everglade 4-4512

Jaw Crushers: 48"x60"; 40"x18"; 30"x36"; 25"x40". Gyratories: 30"; 21"; 20"; 16"; 7".
Butler-Lippmann, covered, washing plant.
Euclid 13 yd. bottom dumps; Athey wagons.
Rotary dryers, 6'5"x60" and 6'x40'.
Shovels: B-E 120B, 48H, 50B, Gs, 3; Link Belt K-45; Lima 120; dies., gas, steel.
Draglines-Cranes: P&H 1055 LC, Marion 80-A, Lima 802, B-E 50B, Manitowoc 2000B.
Locomotives: 7-70 tons, diesel, gas, steam.
B-Erie 2¼ yd. shovel front, 52-B-55 ft.
H. Y. Smith Co. 828 N. B'way, Milwaukee, Wis.

DEPENDABLE USED MACHINES

SPECIAL—Pioneer 505W crushing and washing plant, used one season

Unit ⅛ yd. crane	Diamond single-crusher port. plant	Eagle bucket loader
Bay City ¾ yd. dragline	Badger 2-crusher port. plant	Climax TU engine
Ryers ⅜ yd. dragline	Pioneer 2-crusher port. plant	RD-7 with bulldozer
Universal truck crane	Pioneer 4x8 and 4x10 screens	Erie 8" sand pump
Bay City ⅛ yd. shovel	Int. 1-4 with front end loader	Morris 10" gravel pump

All above equipment reconditioned in our own plant.

10030 S. Ridgeland Ave. TRACTOR & EQUIPMENT CO. Oak Lawn, Ill.

CARLYLE

INDUSTRIAL RUBBER PRODUCTS FOR EVERY PURPOSE

IMMEDIATE DELIVERY OF CONVEYOR, ELEVATOR AND TRANSMISSION BELTING — FIRE, WATER, SUCTION, AIR, STEAM AND WELDING HOSE

WHY WAIT

We have 8 to 48

RUBBER CONVEYOR BELTING

TOUGH COVERS—Heavy duty, specially compounded abrasive resistant rubber covers having high tensile strength. Thoroughly capable of withstanding the abrasive action of bulk materials. Properly vulcanized to the carcass to assure utmost performance, economically.

STRONG CARCASS — Constructed of finest quality 28 and 32 ounce tough cotton duck, properly treated and impregnated to avoid mildew from moisture and atmospheric conditions. Each ply thoroughly embedded in rubber to prevent ply separation.

FLEXIBILITY — Careful attention has been given in the construction of all belts to have the proper flexibility assuring the following desirable features; troughs easily, runs true on all idlers, gauge resistant, excellent for long and short hauls and slope installations.

Avoid delays in your production schedules!

We carry in stock for your immediate requirements, Conveyor Belting in widths from 8 inches to 48 inches.

Width	Ply	Thickness Top Cover	Thickness Bottom Cover	Type of Duck Carcass
8"	4	1/16"	1/32"	28 Oz.
10"	4	1/16"	1/32"	28 Oz.
12"	4	1/16"	1/32"	28 Oz.
14"	4	1/16"	1/32"	28 Oz.
16"	4	1/8"	1/32"	28 Oz.
18"	4	1/8"	1/32"	28 Oz.
20"	4	1/8"	1/32"	28 Oz.
20"	5	1/8"	1/32"	28 Oz.
24"	4	1/8"	1/32"	28 Oz.
24"	5	1/8"	1/32"	28 Oz.
26"	5	1/8"	1/32"	28 Oz.
30"	4	1/8"	1/16"	32 Oz.
30"	5	1/8"	1/16"	32 Oz.
30"	6	1/8"	1/16"	32 Oz.
36"	6	1/8"	1/16"	32 Oz.
42"	5	1/8"	1/16"	32 Oz.
48"	8	1/8"	1/16"	32 Oz.

INQUIRE FOR SIZES NOT LISTED. ELEVATOR TRANSMISSION & V-BELTING ALSO IN STOCK

All our belting made by the leading belting manufacturers.

Write for Free Booklet on Installation, Care & Maintenance of Conveyor Belting.

SEND US YOUR INQUIRIES FOR OTHER RUBBER PRODUCTS.

CARLYLE RUBBER CO., Inc.
62-66 Park Place, New York 7, N. Y.
Phone Digby 9-3810

FOR SALE — LOCOMOTIVE

One Vulcan 10 Ton, Standard Gauge, Gasoline, Locomotive in good operating condition.

DAWES SILICA MINING COMPANY
Thomasville, Georgia

REVOLVING SCREEN

Universal, 16 ft. long x 30 in. dia. revolving screen, less power and drive; punched for 1⅝ in., ⅝ in., ½ in., ¼ in. size, with chip or dust jacket, open end for ballast. Price $900.

FURNIVAL MACHINERY CO.
54th & Lancaster Ave., Phila. 31, Pa.

QUARRY EQUIPMENT

10x20 Beaumont Crusher.

10x7 Allis-Chalmers Blake type jaw crusher.

No. 1 Cedarapids Kubit impact breaker.

60-ton 2-compartment storage bins with clamshell gates.

Cedarapids screening and scalping units.

SHOVELS AND CRANES

Lorain 77 diesel powered 1½ yd. shovel and crane. Caterpillar D13000 engine.

Lorain 75H Cummins supercharged diesel powered shovel and crane.

Lorain 75B, 1¼ yd. shovel, gas power.

Marion 25-ton diesel powered heavy duty truck crane on heavily reinforced Mack.

P&H Model 625A 15-ton crawler crane.

Brownhoist 1 yd. gas shovel and crane.

Lorain 30 combination ¾ yd. shovel, hoe and clam. Universal truck crane.

BELT CONVEYORS

18"—24"—30"—36"
Lattice or channel. "Sealed-for-life" Idlers.

GENERATORS AND LIGHT PLANTS

1½ KW to 125 KW, alternating and direct current, gasoline and diesel powered.

AIR COMPRESSORS

Ingersoll-Rand 105 on rubber, Waukesha gas.

Gardner-Denver 105 on '41 Ford with air receiver, hose reel, power takeoff.

Gardner-Denver 105 on '42 Ford with Wood 2 yd. dump body, air receiver, V-belt driven from power takeoff.

LeRoi 2-stage 105, air-cooled, skid mounted, built-in tool boxes, hose reels and hose.

Gardner-Denver 2-stage 160, skid mounted.

Schramm 210 with International UD14 diesel.

Worthington 210, 2-stage, air-cooled, on steel wheels with Hercules diesel.

Chicago Pneumatic 210, 2-stage, air-cooled Caterpillar diesel on rubber tired wheels.

Gardner-Denver 315, 2-stage, skid mounted. Murphy 6-cylinder diesel.

Pennsylvania 12"x10" class 3A, single cpl., 355 cu. ft., flat belt drive, 50 HP slip ring motor.

New Gardner-Denver 500, 2-stage, water-cooled, D13000 Caterpillar diesel on 4 pneumatics. Used 2 months.

Worthington 2-stage, water-cooled, vertical 250 lb., 60 CFM, diesel starting compressor, new condition.

L. B. SMITH, INC.
Camp Hill, Pa.
Phone Harrisburg 7-3431

FOR SALE

1—B & W coal pulverizer
1—American pulverizer with 125 HP motor
1—Hammer mill 42"x36"
1—70 HP Marine type diesel engine
1—Vacuum pump
1—Deck hoist
Tug boat
Electric motors AC
Generator sets 30 KW & 50 KW
Air compressors
Link Belt pan conveyors 36'x22' Centers
Richardson automatic scales
2—Fuller-Kinyon pump 6"
1—Fuller-Kinyon rotary compressor
1—10'x150' kiln with new liners
Fuller clinker cooling equipment for 10' kiln
Schmidth tube mill 6'6"x20'
5½'x22' tube mills
⅜" Banding tape
4" and 5" 2 and 3-way cement control gate valves
3—Small gasoline driven generators
Chain and belt elevators

OLLIE E. LAWRENCE
P.O. Box 688 Quincy, Michigan

FOR SALE CHEAP

2—New D-13000 Caterpillar Diesel engines, 150 H.P. Complete with Clutches and pulley drives.
1—Schramm Diesel 315 cu. ft. 2 stage complete 1947
1—LeRoi Diesel 315 cu. ft. 2 stage comp. 1946.
1—25 ton Davenport diesel Loco, std. gauge, new 1947
1—50 ton Porter Loco. 0-6-0 Std. gauge

HARRY C. LEWIS
899 E. Grand St. Elizabeth, N. J.

FOR SALE

Kennedy-Dodge 6"x8" jaw crusher
Champion jaw crushers: 7¼x13 and 9x15
Farrel B 13"x24" jaw crusher
Buchanan B 10"x16" jaw crusher
Farrel A 10"x16" Blake jaw crusher
Jeffrey single roll 18"x15" coal crusher
Heavy duty double roll crusher, 28"x18"
Stevens-Adamson 18" KNITTEL crusher, ball bearing
Laboratory grinders as 1 peg crushing rolls
Simplicity single deck 6'x8' scalping screen
Tyler Type 400 single deck 4'x8' screen
4 enclosed 3'x5' single deck Hummer screens
New and used Universal vibrating screens
2 Leahy single deck 4'x8' vibrating screens
Bucket elevators open and enclosed, complete
75' Perfect Discharge 12" bucket elevator
Inclined and vertical elevators, 4" to 16" buckets
Standard chain for elevators and drives
Elevator belt, pulleys, sprockets, buckets, housing
Thimble roller chain of 4"-6"-8" pitch
Slat conveyor 30" wide, 50' long
Portable conveyors 18"x10', 18"x25'
Apron steel conveyors: 18"-24"-30" wide
Single strand 12" Flight coal conveyor
New 36" and 30" belt idlers with Timken bearings, belt and pulleys
New 24" and 18" belt idlers and belt and pulleys
Screw and gravity conveyors
V pulleys, gears, sprockets, drive pulleys
Feeders for conveyors and elevators
Pumps: Electric, steam, gasoline
Ten ton, 20' span, 3 motor electric overhead crane
1 ft new airhoist 10,000 lb. cap., on trolleys
Seven magnetic belt pulleys
Yale & Towne 5 ton Kron crane scale with dial, new
Selected gear reducers ½ to 75 hp.
Gearmotors and variable speed motor units
Electric and air cable hoists, Reeves drives
Bin gates: 12"x12", 15"x15", 20"x20" openings
Link Belt Car Spotter, 5000 lb. capacity

G. A. UNVERZAGT & SONS
136 Colt St. Irvington, N. J.

FOR SALE

1—GIW 6" rt. hand bottom discharge, heavy duty, volute Sand and Gravel pump complete with GMC Diesel motor model 6052SC, auto alarm, muffler, V-belt drive and belts with 8" intake fittings. Mounted on heavy duty frame.
1—Gruendler 4'x12' Revolving screen, mounted on heavy duty skids, to pass minus 8 mesh with 15 HP Master parallel shaft gear head motor with V-belt drive.

All of the above equipment is new and never been used. Plans were changed reason for selling. Will sell FOB our plant for quick sale—$6750.00.

Southeastern Concrete Products Co.
Box 337 CAYCE, S. C. Phone 6707

FOR SALE

1 Worthington Heavy Duty Screen 6'x26'
1 Cummer Drier. Needs Repairs
We have a Worthington Superior Jaw Crusher 42"x40" in excellent condition. Would like to trade for a 60"x48" Farrel

STOUGHTON CRUSHED STONE CO.
Stoughton, Mass.

FOR SALE

Two Link Belt PD 2412 vibrating screens, 4'x12' double deck. In excellent condition.

M. S. WRIGHT, III
Old Bridge, N. J.

FOR SALE

¾ yd. P&H Crane—Model 206 40 ft Boom—good condition. Will price to sell.

CHILLICOTHE GRAVEL CO.
Chillicothe Illinois

SHOVELS: Electric, 4 yd. capacity. 1—Marion 4161 and 1—Bucyrus-Erie Model 120-B 2200 volt A.C. 1—P&H model 655-B, diesel, 1½ yd. capacity with D13000 caterpillar motor, used only 1700 hours.

SHOVEL ATTACHMENTS: for Lima 802 shovel, 2 yd. capacity. NEW condition.

ROD MILL: Marcy 7'x16', open end, with 200 H.P. A.C. motor for wet grinding.

HARDINGE BALL MILL: 10'x36" conical mill with 300 H.P. A.C. motor and all auxiliary equipment, for dry grinding.

AIR SEPARATOR: Gayro 14 ft. complete with motor drive.

HAMMER MILL: Jeffrey 24x36, type B-3, roller bearing equipped, used only two weeks.

CRUSHER SPECIALS: 1—Allis Chalmers 7½ K Gates. 1—Farrel 24x36" Jaw Crusher, located Michigan.

DRYER: Allis Chalmers 10 ft. x 90 ft. single shell, heavy duty, with or without dust collector, motors, fan, conveyor, etc., located Minnesota.

DERRICKS: 1—75 ton Stiff Leg, 100 ft. boom. 1—35 ton Guy, 88 ft. boom, 98 ft. mast.

A. J. O'NEILL
Lansdowne, Pennsylvania
Phila. Phone: Madison 3-8300—3-8301

FOR SALE

CRANE—P&H Crawler Model 600 with 45' boom

CRANE—Universal Truck Crane on Mack chassis. These units in good operating condition.

BOOM—for 80 Northwest, 65' long

G. & W. H. Corson, Inc.
Plymouth Meeting, Pa.

FOR SALE

Winton 350 H.P. Gas Engine
Very good condition.
Plenty of spare parts.
Has been used on Gravel Pump.
$1250.00

ADVANCE BUILDING MATERIALS CO.
5217 Ryan St. Utica, Mich.

FOR SALE

New Gould Water Pump; 8" two stage capacity, 1000 GPM, 300 foot head, 1750 RPM. The Cumberland Cement & Supply Company, Cumberland, Maryland.

FOR SALE

1 Converso Rotary sand screen brand new equipped with automatic cleaners, screen 11 feet long 3 feet diameter equipped for 1 hp electric motor. Bargain

LATHAM SAND & GRAVEL CO.
Orient, N. Y.

ALSO SEE READY-MIXED CONCRETE AND CONCRETE PRODUCTS EQUIPMENT CLASSIFIED ADVERTISING IN CONCRETE PRODUCTS SECTION

FOR SALE

Six (6) 8'3" x 45'11" Efficient Multi-tube Indirect Rotary Coolers by Traylor for Lime and Alumina Oxide.

THOMAS M. BROWN
1315 Oliver Bldg.—Pittsburgh, Pa.

ELECTRIC HOIST

Lidgerwood Single Drum
Equipped with 40 HP Slip Ring Motor 3/60/220 or 440 Volts
With Drum Type Controller and Resistance
Excellent condition. Attractive price.
Also Vibrating Screens, Conveyors, Coal Crushers, Car Spotters, Etc.
What Do You Need?

THE INDUSTRIAL EQUIPMENT CORP.
910 First National Bank Bldg.
Pittsburgh 22, Pa.

RUBBER CONVEYOR BELTING

At Lower Prices

Top Quality—Immediate Delivery
12" widths to 36" (All plies)
TRANSMISSION BELTING
AIR HOSE (All sizes)
SUCTION and DISCHARGE HOSE
WATER HOSE
V BELTS

Also Mill Remnants

Write or wire collect for prices and samples

E. D. HEEHS & SON
1286 Hollywood Ave., Memphis, Tenn.

FOR SALE

Four (4) Rotary Dryers 8'3" x 45'11" Ideal for Drying Silica, Sand, and Stone.

NEVILLE LIME COMPANY
1316 Oliver Bldg.
Pittsburgh, Pa.

FOR SALE

80 ft. Sauerman Steel Mast, including guy cables, sheaves, blocks, etc. Good condition, purchased new and used less than 2 years.

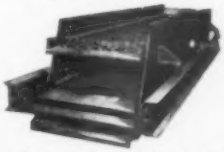
May be seen at our plant at Michigan City, Indiana.

PORTAGE-MANLEY SAND CO.
P. O. Box 58 Portage, Wisconsin

Vibrating Screens - Conveyors - Feeders Scales - Crushers - Conveyor Idlers

Guaranteed Equipment—Immediate Shipment

VIBRATING SCREENS



Heavy duty eccentric shaft types, 1 to 5 decks; screen sizes to 5x14. Priced from $1350 including cloth or plate.

Eccentric weight type screens, 1 to 3 decks; sizes to 3'x8'. Including cloth or plates, from $395.00.

HEAVY DUTY FLIGHT CONVEYORS

Any length. Flights up to 6"x24". All welded structural and sheet steel. Heavy duty, double guided chain. Prices from $495.00.

PORTABLE FLIGHT CONVEYORS

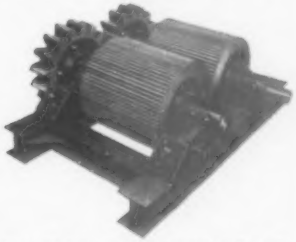
Mounted on rubber tires and adjustable undercarriage. All welded structural and sheet steel; double guided heavy duty chain; steel flights to 6"x24". Electric or gasoline power. Priced from $450.00.

TRUCK SCALES

15 Ton Truck Scales	$456.00
20 Ton Truck Scales	510.00
26 Ton Truck Scales	565.00

Others to 50 ton capacity. All scales complete with structural steel weighbridge. Parts and weighing beams for most makes of motor truck scales.

CINDER, PUMICE, PERLITE CRUSHERS

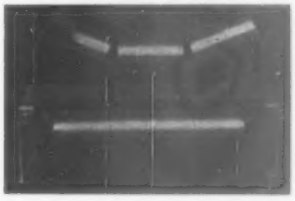


10 to 20 tons per hour capacity, $395.00
25 to 50 tons per hour capacity, 945.00
Complete with hopper

CONVEYORS — PICKING TABLES

Troughing idler conveyors—picking tables. Any length, belt widths to 60". Prices from $395.00

TROUGHING IDLERS AND ROLLERS



All steel. Interchangeable with other well-known makes. Replaceable precision ball bearings. No bearing adjustments required. Easy to start and will run in cold weather. Rust-proof ball races; maintenance is negligible. Build your own conveyors; we have standard sections, head and tail pulleys, take-ups, drives, idlers, speed reducers, sheaves, belting, etc.

3-roll Troughing Idlers for these sizes:

14" belt	$18.50	24" belt	$21.00
16" belt	19.00	30" belt	22.00
18" belt	20.00	36" belt	23.00
42" belt			$24.00

1-Roll Return Idlers for these sizes:

24" belt	$8.25	36" belt	$ 9.75
30" belt	9.00	42" belt	10.50
48" belt			$11.25

More than 3000 mines and quarries have modernized with Bonded equipment.

BONDED SCALE & MACHINE COMPANY
128 Bellview, Columbus 7, Ohio
Phones: Garfield 2186; Eves. University 2832

ALSO SEE READY-MIXED CONCRETE AND CONCRETE PRODUCTS EQUIPMENT CLASSIFIED ADVERTISING IN CONCRETE PRODUCTS SECTION

FOR SALE

Shovels and Cranes

Model 6 Northwest Shovel 1½ yd. with 6-71 Gen. Motors Diesel Motor . $14,000
Model 6 Northwest Crane, Dragline, Gas. Motor $11,000
Osgood 1 yd. Comb. Shovel and Crane Gas. Motor, 6 Cyl. $7,000
Michigan, ⅜ yd. Truck Crane 25' Boom $4,750
Lorain 40, ½ yd. Truck Crane Mack Truck $4,250
Bay City K2 ½ yd. Comb. Shovel, Crane Gas $5,000
P&H 655A 1½ yd. Shovel, Crane, Dragline, D13000 Diesel $19,500

Slackline Cableways

Sauerman Two Speed Hoist with D13000 Cat. Diesel Motor 2½ yd. Bucket 125' Mast $12,500
Thomas Two Speed Hoist 100 HP Elec. Motor 1 yd. Sauerman Bucket 90' Mast, Trackline, Cables, Blocks, Complete $8,500
Sauerman 2 Drum Dragscraper Hoist with 60 HP Elec. Motor 1½ yd. Dragscraper, Hoist, Mast, Cables $4,500

Trenching Machines

No. 12 Buckeye Wheel 24"x6' Cut $5,500
Barber-Greene 44A 18"x5'6" Deep $1,800
Buckeye C15 42"x18' $6,800
Buckeye C10 42" width x 14' $4,800

Pavers and Other Equipment

34E Foote & Ransome Rebuilt and very good. Each $9,000
27E Rex Paver, New Drum, all very good condition $1,800
10 Ton Huber 3 Wh. 20" Rolls. Buda Motor, Scarifier $3,000
Gallon Patch Roller, Rubber Travel Wheels, 5 Ton $700
2—D8 Cat. Tractors with Blades $4,800 and $6,800
Blaw-Knox Clamshell Model 661 with Teeth ½ yd. $515
Heilnke ¾ yd. Gen. Purpose with Teeth Very Good $750
UD 18 Int. Diesel with 60 KW Gen. $3,500
24" Stedman Impact Crusher Good as New and Extra Impeller $1,200
Mundy 2 Dr. 2 Speed Dragscraper Gas. Hoist $1,250
6 Horsburgh-Scott Worm Reducers Ratio 400 to 1 Ea. $250
B-G Belt Conveyors 24"x100' and 24"x80' $1900 and $1,000
Complete Quarry Equipment, Land Buildings, Crushers, Trucks, Office, Scales, 70,000 Ton Cap. Highway and Ag. Lime $40,000
Dayton-Dowd 6" Cent. Pump with 60 HP Elec. Motor $950
We have other equipment, let us know what you want to buy or sell.

THE T. J. LANE CO.
Box 665 Springfield, Ohio
Dial 2-3362 or 3-3761

BELT CONVEYORS FOR SALE

1—42"x450' Robins Belt Conveyor with Robins anti-friction troughing and return idlers with dual drive gear reducer and 75 H.P. A.C. motor.

1—42"x125' Robins Conveyor, same specifications.

Please send for details and low price.

CONSOLIDATED PRODUCTS CO., INC.
15-16-17 Park Row, New York 7, N. Y.
Phone: BArclay 7-0600

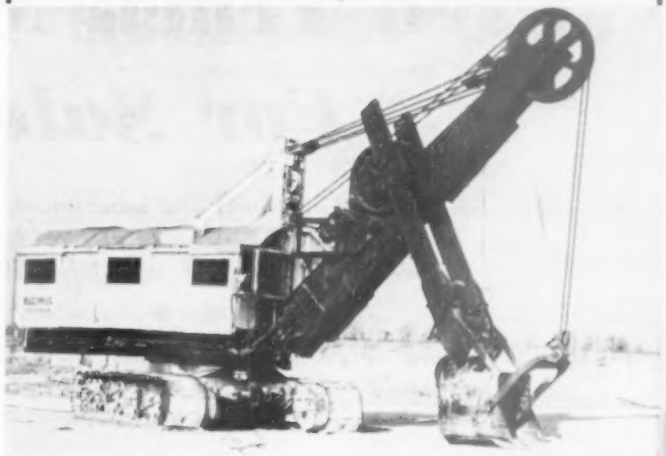
FOR SALE

Gruendler Center feed hammermill Mod. 2XB 15 t.p.h. with V belt drive 20 H.P. 3/60/220 motor G.E. compensator, all in good condition. $1250.00 complete. Will sell without motor and drive.

10x20 Good Roads roller bearing jaw crusher in good condition. Extra toggle. $1150.00. Will trade either of the above on 18" belt conveyor or longer.

Gallatin Sand & Gravel Co.
Phone 2653 Warsaw, Ky.

Immediately Available



Bucyrus-Erie 120-B 4 cu. yd. Electric shovel mounted on caterpillars 17' overall width of crawlers. 29'6" boom. New 20'6" dipper handles attached; G.E. controls. Large stock spare parts includes new boom. Full specifications, photographs and parts list sent on request. **Inspection welcome.**

BASIC REFRACTORIES, Inc. 845 Hanna Building Cleveland 15, Ohio

FOR SALE

40 ton Orton diesel locom. crane new 1942
50 ton Whitcomb diesel elec. loco. new 1942
30 ton Davenport diesel loco. new 1942
20 Koppel 20 yd. air dump cars
1300 ft. Ing. Rand 350 HP elec. air compressors.
1400 HP Fairbanks Morse 970 KW diesel generator
40 ton steel stiffleg derrick. Amer. 3d hoist
150 HP Kewanee portable boilers. ASME
150 KW Busch Sulzer 220/440 diesel generator

MISSISSIPPI VALLEY EQUIPMENT CO.
513 Locust St. St. Louis 1, Mo.

BARGAINS

DERRICKS, HOISTS, COMPRESSORS Drills, Steels, Bits, Truck Mixers BINS, ELEVATORS, CONVEYORS, ETC.

DRAVO-DOYLE COMPANY
2601 Preble Ave. Pittsburgh, Pa.

FOR SALE

Very reasonably
1¾ yd. "MARION" Elec.
SHOVEL
Type 37 Crawler
"AMSCO" Dipper
A-1 Oper. Condtn.
Big lot New
PARTS
for
Demonstration
Apply

J. S. HOWER CO.
Utica, N. Y. Phone 2-5218

BACK AGAIN

HAVE OPENED UP AT 4560 BROADWAY, CHICAGO. WILL BUY, SELL, RENT, TRADE, INSPECT AND APPRAISE CONSTRUCTION and QUARRY EQUIPMENT. LET ME KNOW WHAT YOU HAVE TO DISPOSE OF AND YOUR IMMEDIATE NEEDS.

DICK EVANS

4560 Broadway, Chicago, Ill. Phone: Uptown 8-0826

Used Truck Mixers

For Sale

All late models mounted on trucks and unmounted. All makes and sizes from 3 yards to 5½ yards
Both HORIZONTAL and HI-DISCHARGE

•

50 used late model Jaeger Building Mixers, sizes 6EL, 11EL, 16EL, mounted 2 pneumatic tires. Reconditioned. Immediate delivery. Prices attractive.

•

JAEGER-LEMBO MACHINE CORPORATION

127th St. and Northern Blvd. Corona, L. I., New York
WIRE *PHONE* Newtown 9-7777 *WRITE*

CRUSHERS: Gyratory 20", 36", 42", and 48". Nos. 12, 10, 9, 7½, 6, 5 Allis-Chal. and others.
JAW TYPE: 24x36, 22x40, 28x36, 40x48, etc.
CONE TY. Symons 2, 3, 4, and 5½'. No. 36 Telsmith. Also Kennedy 19, 25, 37, and 49. Traylor 13" and 24" TY. Newhouse 7, 10 and 14". Steadman 24, 30 and 36" Impact. Allis-Chalmers Ty. B.
ROLLS: Allis-Chal. 72x36, 54x24, 54x20, 40x15 and 18x10. Pioneer 18x20. Universal 16x24. New Holland 24x10 and 16x16. McLanahan 18x28 and 18x36.
HAMMERMILLS: Williams Nos. 2, 3, 4 and 6. Day Nos. 40 and 70. Gruendler 2XH and 3XH. Disie 2040, 3050 and 5040, and others.
MILLS: Hardinge 3'x8", 6'x22", 6'x5' and 8'x14'. Kennedy 4x8, 5x6, 5x11, Marcy 4x5, 6x8, 7x16. Raymonds, Sturtevants and others.
CRUSHING PLANTS: 24x36, 22x40, 20x42 and smaller. Also complete stationary plants.
KILNS: 40'x250', 9'6x125', 8'x100'150' and 8x115'.
DRYERS: 30'x60', 7'x50', 10'x40', 8'x50', Etc.
DRAGLINES: ¾ Yd. Page 145', 12 Yd. B.E. 105' Diesel Walkers. B-E 2½ Yd. 100' Elect. Cats. Other sizes down to ¾ yd.
BINS & BATCHERS: 20 yd. capacity & larger.

MISCELLANEOUS ITEMS

Barges, Bins, Buckets, Boilers, Cableways, Cars, Compressors, Conveyors, Cranes, Dryer, Derricks, Elevators, Excavators, Generators, Hoists, Kilns, Draglines, Drag Scrapers, Dredges, Drills, Engines, Locomotives, Loaders, Motors, Pipe, Pumps, Rail, Scales, Screens, Shacklines, Shovels, Tanks, Trucks, Tractors, Etc., in many sizes, types and makes at low prices. (I have equipment at many points in the United States and Canada. What you need may be near your plant.)

MARIETTA ALEX T. McLEOD KANSAS

CRUSHERS, ETC.

1—Kent Maxecon-Type No. 7 Ring Roll Mill and Drive.
1—Sturtevant No. 2 Ring Roll Mill and Drives.
1—Sturtevant No. 1 Ring Roll Mill.
1—Pair Rolls, Allis-Chalmers 46"x15", Anaconda. Completely rebuilt.
1—No. 4½ Traylor Gyr. Crusher.
1—No. 4½ Champion Jaw Crusher, 10" x20".
1—Jeffrey Swing Hammer Mill, Type B, 24"x20".
1—No. 5 Champion Jaw Crusher 11"x 26".
1—4'x5' Tyler Hummer D. Deck Vibrating screen.
1—18" Link-Belt Apron Conveyor—9" pitch, 27" centers.
Bucket Elevators, open and totally enclosed, new and used, as is or rebuilt.

JOHNSON & HOEHLER, INC.
P.O. Box 102 Lansdowne, Pa.

FOR SALE
QUARRY EQUIPMENT

19—Easton Standard Phoenix Cars of 8 yds. capacity for 4'8½" gauge track, furnished complete with oak cushion and steel liner plate, side dump. Equipped with ¾ size automatic couplers and spring draft rigging and with hand wheel type brakes operating on all four wheels of car.
3—Whitcomb Gasoline Locomotives, 15 tons, class LRX-1, gauge 56½".
3—Heavy duty Disappearing Top Barney Cars, gauge 29½". Spare parts included for the above equipment. Above equipment in good operating condition.

The above may be inspected at Bath, Penna.

KEYSTONE PORTLAND CEMENT COMPANY
Bath, Pennsylvania

FOR SALE

1—18x30 Cedar Rapids Factory reconditioned Roll Crusher with 2 Extra Roll Shells.

HOLMES-TALCOTT COMPANY
Hartford, Conn.

EQUIPMENT

NEW
Installed Never Used

Traylor Rotary Coolers
Stephens Adamson Car Pullers
Ingersoll Rand Vacuum Pumps
Oliver United Drum Filters
U Shaped Mixing Tanks with Agitators
Coltan-Lang Recuperators
Switchboards
Electric Motors
Pumps
Transformers
Reducers
Motorized Reducers
Meters and Recorders
Regulators and Controllers
E. C. & M. Motor Starters
Bucket Wheel Feeders

USED
Limited Use Only

Oliver United Disc Filters
Steel Tanks
Dorr Agitators
U Shaped Mixing Tanks with Agitators
Marley Cooling Tower
Collan-Lang Recuperators
Electric Motors
Regulators and Controllers
Switchboards
Reducers
Pumps
Transformers
E. C. & M. Motor Starters
Motorized Reducers
Meters and Recorders
Bucket Wheel Feeders

Write Today For Complete Description and Prices. ACT NOW AND SAVE

Mill & Quarry Equipment Company

P.O. Box 1488 Baton Rouge, Louisiana Phone 5-7741

SALE OR RENT

1—Lima 34 Truck Crane 80' Boom.
1—Koehring 304-Diesel S, C and Rhoe.
1—Northwest No. 6 Diesel S and Dragline.
1—American 6-85 Revolver 90' B. 3/60/440V.
1—45' Crane Boom for Link Belt LS90 —New.
1—30 Ton Plymouth Std. Ga. Gasoline Loco.
1—40 Ton Orton Diesel Loco. Crane.
1—30 Ton Browning Steam Loco. Crane.
3—American Guy Derricks, 20, 100 and 200 ton capy. with or without hoists.

S. M. WEISS COMPANY
Girard Trust Co. Bldg. Phila. 2, Pa.
Rittenhouse 6-2311

ALSO SEE READY-MIXED CONCRETE AND CONCRETE PRODUCTS EQUIPMENT CLASSIFIED ADVERTISING IN CONCRETE PRODUCTS SECTION

FOR SALE

FOR SALE

Complete Sand & Gravel Plant. 500 yard per day capacity. All electric. 4 Heltzel sectional steel trailer bins. New Robins Vibrex screens and Allen sand-washing tanks. New Conveyor belts. All steel bolted construction; can be easily dismantled and moved. Price reasonable for quick sale. Inventory on request.

CORTLAND STONE CORP.

1000 No. Division St., Peekskill, N. Y.

GRAVEL SAND

5,000,000 cu. yds.
6 miles from New Jersey Turnpike
Phone—Write—Call

Benjamin C. WARNICK

Freehold RFD4 **New Jersey**

CORE DRILLING

CORE DRILLING
—anywhere!

"We look into the earth"

PENNSYLVANIA DRILLING COMPANY

Pittsburgh 20, Pa.

POSITIONS VACANT

WANTED

Wanted, capable sales engineer experienced in Concrete Pipe, Bituminous materials, Sand and Gravel. Must be active, experienced in handling sales correspondence. Prefer man with experience in Southeast area. All replies are confidential and request complete information in first letter. Address Box I-80, Rock Products, 309 W. Jackson Blvd., Chicago 6, Ill.

Lime plant production superintendent. Azbe type shaft kilns southwestern location — give experience, age, family and salary requirements. Box I-76, Rock Products, 309 W. Jackson Blvd., Chicago 6, Illinois.

POSITIONS WANTED

SALES POSITION with line of heavy equipment for rock products and allied industries in eastern Pennsylvania and immediately adjacent areas desired by college graduate thoroughly familiar and experienced in various phases of field from past positions. Qualifications include considerable sales experience in addition to executive management and operation of quarry, owner and operator of building block business and analytical chemist position in cement plant. Permanent worthwhile selling connection desired. Address Box I-65, Rock Products, 309 W. Jackson Blvd., Chicago 6, Illinois.

EQUIPMENT WANTED

WANTED AT ONCE

Brooks Load Luggers

Models CH 150-200 and larger.

We pay best prices for Hoists and Buckets in good condition

GENERAL TRADERS, INC.

2675 West Grand Ave. **Chicago 12, Ill.**

WANTED

Carload used 60 lb. railroad rail—

ESSARY GYPSUM COMPANY, INC.

Caledonia, New York

WANTED

Spare parts for Raymond Roller Mills

Box I-84, Rock Products, 309 W. Jackson Blvd., Chicago 6, Ill.

WANTED TO BUY

Portable crushing and screening gravel plant, 25-50 T.P.H. Must be priced right and located within 500 miles of Pittsburgh, Pennsylvania.

Write P.O. Box 8747, Pittsburgh 21, Pennsylvania

WANTED

Wanted, 1½ yard backhoe attachment for Model 6 Northwest. State condition, price, location.

Austin Road Company, Dallas, Texas
1000 Singleton Blvd. **Phone C-6401**

CONSULTING ENGINEERS

Quarries
Crushing Plants
Cement Plants
Storage Methods
Operating Costs

E. LEE HEIDENREICH JR.

Consulting Engineers
67 Second Street, Newburgh, N. Y.
Phone 1828

Operation
Plant Layout
Design
Appraisals
Construction

PLANT ENGINEERING—LAYOUT—DESIGN
PROCESS AND CONVEYING EQUIPMENT

Philadelphia
3307 Spring Garden
Phila. 4, Penna.
EVergreen 6-2479

WM. E. ROBINSON
Consultant Designer

New York
Room 2407
220 E. 42nd St.
MU. Hill 2-0697

GEOPHYSICAL and GEOLOGICAL SERVICES

Mine & Quarry Services, Inc.

Geological and Geophysical Services to the Mineral and Engineering Industries

340 North Vandeventer Ave.
St. Louis 8, Missouri
Franklin 1002

Resistivity Surveys
Geological Investigations
Geophysical Research
Quarry Overburden Investigations
Limestone, Sand and Gravel Prospecting and Plant Location
Water Supply Investigations

ROCK PRODUCTS
THE RECOGNIZED AUTHORITY
MOST WIDELY READ
MOST OFTEN QUOTED
BUILT ON EDITORIAL SERVICE
ESTABLISHED 1896

Read each month by 14,102 in the industry. Join this progressive group by sending your subscription order. Two years, $3.00 — One year, $2.00.

ROCK PRODUCTS, the recognized authority of the non-metallics industry, is the most widely read and most often quoted magazine serving the field.

Rock Products Editors seek out and evaluate new production methods that permit lower costs and greater profit. You can benefit as each of 14,102 readers benefit by having your own personal copy for monthly study. Order to-day.

ROCK PRODUCTS 309 W. Jackson Blvd. Chicago 6, Illinois

INDEX TO DISPLAY ADVERTISERS

INDEX TO CLASSIFIED ADVERTISERS

ALSO SEE INDEX OF CONCRETE PRODUCTS SECTION ADVERTISERS ON PAGE 248

PERFORMANCE ✓OUTSTANDING

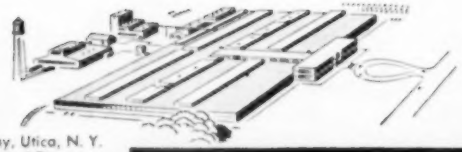
Here's a new sinker—the CP-59—that outperforms any other drill in its class (55 pounds). It has remarkably high drilling speed . . . exceptionally strong rotation . . . unsurpassed hole cleaning . . . excellent riding qualities.

Its design incorporates all the factors that make for fast, efficient, economical operation.

Low maintenance is assured by such features as a replaceable bronze chuck rotation nut to protect piston splines from scoring and a replaceable bronze cylinder bushing liner to make it easy to maintain piston alignment and full cushioning.

The CP-59 is equipped with a 4-in-1 backhead. Rapid and inexpensive changeovers make possible plain dry, blower dry, plain wet or air-wet operation.

Have your nearest CP dealer give you a demonstration of this outstanding drill, or write for a copy of SP-3009.



With its half million square feet of floor space, Chicago Pneumatic's new Utica unit is the world's most modern plant for the production of pneumatic and electric tools.

Chicago Pneumatic Tool Company, Utica, N. Y.

CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

readily available

AMERICAN
CYANAMID COMPANY
EXPLOSIVES

AMERICAN EXPLOSIVES

You can get quick deliveries of AMERICAN explosives and blasting supplies from our well located plants and distributing magazines. The AMERICAN line includes explosives exactly suited to your requirements—produced under intensive research, close chemical control, and unremitting care in manufacture. Always specify AMERICAN.

Capable Field Engineers
Are Available At Your Call

*** High Explosives * Permissibles**

*** Blasting Powder * Blasting Accessories**

AMERICAN Cyanamid COMPANY
EXPLOSIVES DEPARTMENT
30 ROCKEFELLER PLAZA • NEW YORK 20, N. Y.

Sales Offices: Pittsburgh, Pa. • Bluefield, W. Va. • Scranton, Pa. • Chicago, Ill. • Pottsville, Pa. • Maynard, Mass.

Another Goodyear First—

A new cord material that gives V-Belts

40% higher HP ratings Highest shock-load resistance without excessive stretch

HEART of these belts is a new, chemically produced fiber that has nylon's *strength, without its stretch*. This newly developed material is the reason why HY-T Multi-V-Belts boast horsepower ratings 40% above ordinary belts.

That means you can handle heavier loads with fewer belts—7 HY-T belts will walk away with a load that requires 10 regular belts! What's more, they're built to take heavy shock-loads in stride—give outstanding flex-life on *all* diameter sheaves, and at all speeds within Goodyear or RMA recommendations.

Now V-Belt users everywhere can get the ideal combination of characteristics for heavy-duty, high-shock-load service with Goodyear's NEW HY-T belts. Designed to meet the most exacting requirements—tested on hundreds of tough drives—these belts are now in production and will soon be available in standard sizes through your nearest Goodyear Industrial Rubber Products Distributor.

Ask the G.T.M.—Goodyear Technical Man—or your nearest Goodyear Distributor to show you how to end your drive problems with this new belt that has the highest HP rating and longest flex-life of any fiber construction belt on the market. Or write Goodyear, Akron 16, Ohio.

You get all nine with Goodyear's NEW HY-T Multi-V-Belts

- HIGHER HP RATING
- REDUCED STRETCH
- LONG FLEX-LIFE
- HIGH SHOCK-LOAD RESISTANCE
- COOL RUNNING
- OIL RESISTANCE
- RESISTS AGING
- STATIC CONDUCTION
- MILDEW RESISTANCE

FOR HOSE, FLAT BELTS, V-BELTS, MOLDED GOODS, PACKING, TANK LINING built to the world's highest standard of quality, phone your nearest Goodyear Industrial Rubber Products Distributor.

GOODYEAR

THE GREATEST NAME IN RUBBER